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ABSTRACT

Profound changes are occurring in technology, work, and work organization with equally profound implications for the future role of vocational education and training (VET) in Australia. The changes have the following six interrelated elements that tend to affect one another. (1) globalization is creating a more internationalized economy and culture; (2) international competition is driving an accelerated rate of technological change in information and communications; (3) technology is associated with a sharp drop in skilled blue-collar work, a sharp rise in skilled and semi-skilled white-collar work, and no increase in jobs overall; (4) organizational change is immense but uneven, in that the post-Fordist vision of flatter structures, loose networks, and stimulating work is not occurring, although workplaces based on high participation, strong teams, and integrated, multiskilled jobs make productivity gains; (5) non-standard work and flexible hours have sharply increased; and (6) there is a growing polarization in income, in access to work and work security, and to technologies. The key elements in the future role of VET are its capacity to integrate more closely with the workplace and to integrate into the innovation cycle; on-the-job training is the aspect that has been underestimated so far. (An appendix contains 91 references. An 86-item annotated bibliography is attached, with a list of 213 other materials included in the study.) (YLB)

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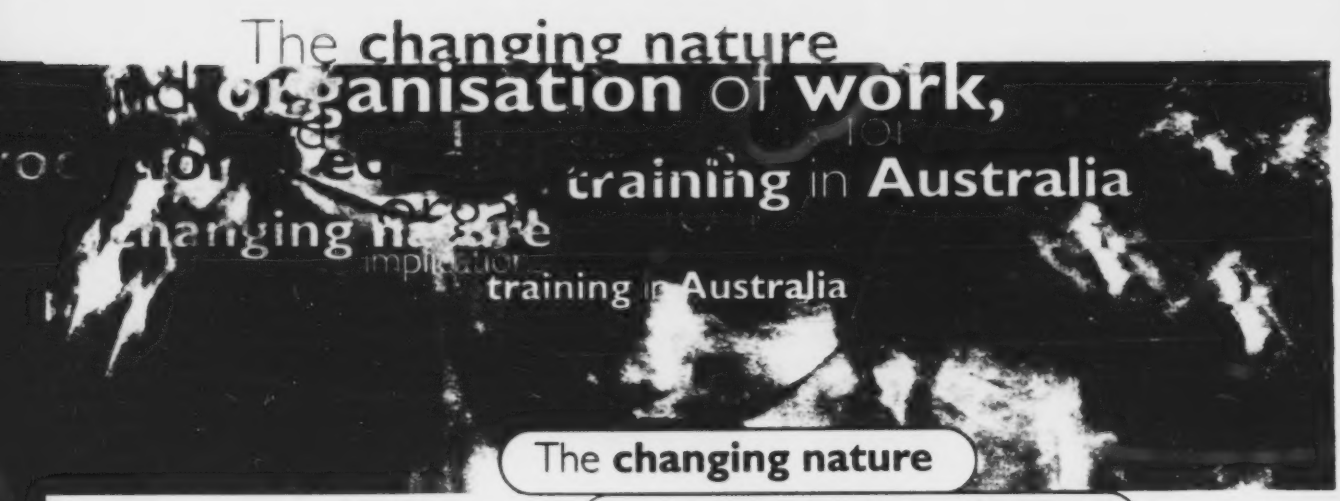

The **changing nature** and **organisation** of **work,** and the **implications** for **vocational education** and **training** in **Australia:** **ISSUES PAPER**

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Simon Marginson

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Executive summary

Profound changes are occurring in technology, work and work organisation, with equally profound implications for the future role of vocational education and training (VET) in Australia. These changes have six elements, all of which are interrelated and tend to affect one other:

- Globalisation is creating a more internationalised economy and culture. The cost of travel and communications have been dramatically reduced. Above all, the world is now networked with more intensive and extensive relationships at every level. The nation is still a key factor in the global environment; but industry, government and VET institutions must become totally engaged with the global environment or face obsolescence.
- International competition is driving an accelerated rate of technological change, above all, in information and communications, which are key sources of productivity advance. Networked computing is associated with a workplace that is both more integrated and more devolved, and requires higher levels of cognitive and interactive skills.
- Technology is associated with a sharp drop in skilled blue-collar work, a sharp rise in skilled and semi-skilled white-collar work, and no increase in jobs overall. The most advanced companies are shedding labour.
- There is immense but uneven organisational change. The post-Fordist vision of flatter structures, loose networks and stimulating work all round is not occurring, although workplaces based on high participation, strong teams and integrated, multi-skilled jobs do tend to make productivity gains.
- There has been a sharp increase in non-standard work, especially part-time and casual labour, and people working shorter or longer hours. There is also growth in 'telework' in the home, outsourcing and contracting out, and work for 'temping' agencies instead of stable employers. Most of this 'flexible' work is actually flexible only for the employer.
- There is a growing polarisation in incomes, in access to work and work security, and to technologies. There has been great growth in two-income families and no-income families, and a decline in one-income families.

The future of work will be shaped by technology, the capacity of labour, and change management. Training, along with research and development, work organisation and capital raising, will determine whether the Australian economy is a high-skill economy that provides for rising standards of living. The key elements in the future role of VET will be its capacity to integrate more closely with the workplace, and its capacity to integrate into the innovation cycle.

The aspect that has been under-estimated so far is *on-the-job training*—partly because it is difficult to identify where work ends and on-the-job training begins. (One study found that employer estimates of the amount of on-the-job training were 25 per cent higher than worker estimates.) On-the-job training leads to clear-cut productivity gains and is strongly supported by workers themselves. More use of mixed-mode (work/study) training programs is also essential.

If it can help to ease the passage into new technologies and speed the rate of their diffusion, VET can make a very major contribution to the competitiveness of Australian industry. Even more strategically significant is the development of a capacity in *continuous innovation*. Few firms are able to maintain this capacity and it is a major source of competitive advantage. It depends not only on flexible structures and on training at the cutting edge, but also the development of a workplace culture that is *skill reflective*—a workplace in which workers can

put into practice their own judgements about the skills and knowledge they need to acquire in order to meet the needs of competition and technology.

To play this part, VET and its practitioners will need to become more global, better networked and closer to the technological edge in every industry. This is part of the 'public good' function of VET. In Australia, unlike most countries, the big firms—many of them the local branches of multinationals—tend to be weaker innovators than some of the small local firms. Yet the small firms do not have the capital they need. The role of government is therefore crucial, not least in supporting the targetted provision of general and industry training as required.

The role of government is important in other ways. A number of studies show that training opportunities tend to go to those with advanced levels of education (although this is less true at higher rates of technological change). Government and VET provide compensatory opportunities in an increasingly polarised setting. One of the major challenges before public policy in VET is to extend the policy network to non-standard workers. Given the growing role of this sector of the workforce, the provision of structured training is not only essential for equity reasons, it goes to the heart of future workforce quality.

The big picture

> *Flexible accumulation ... rests on flexibility with respect to labour processes, labour markets, products, and patterns of consumption. It is characterised by the emergence of entirely new sectors of production, new ways of providing financial services, new markets, and, above all, greatly intensified rates of commercial, technological, and organisational innovation.*
>
> (Harvey 1990, p. 147)

Global and national

Globalisation defined

The trend to the global—'globalisation'—is not just an economic process as is often presented. It also has social and cultural roots. In many respects it is in the cultural realm that globalisation has become associated with a distinctly new kind of working and living, with its many implications for education and training. Globalisation is more than international trade or production, both of which have been with us for a long time, and where the recent increase in activity is sometimes exaggerated (Giussani 1996; Hirst & Thompson 1996). The process of globalisation is informed by the growing role of *world systems* and the creation of *more intensive and extensive relationships between people*, whether across national borders or close to home.

The common element in the globalisation of the economy, government, population, media and entertainment, and sectors such as education and training, is the declining cost and growing role of communications and transport networks. Between 1970 and 1990 there was a dramatic fall in communications costs, and these have declined further since. For example, in the 20 years after 1970, the price/performance ratio of computing fell by a factor of 20 (see table), but in the 20 years after 1975 it fell by a factor of 10 000 (Sheehan & Tikhomirova 1998b, pp. 30–2).

Table 1: Declining costs of global transport and communications, 1970–90

	Average air transport revenue per passenger mile	Cost of a 3 minute phone call between New York and London	Cost of computer power (US Department of Commerce index)
1970	100	100	100
1990	69	11	5

Source: International Monetary Fund 1997, p. 46

Airlines, telephones, the Internet and e-mail are the key to growing business travel, tourism, educational travel and migration, and to increasing electronic contact and economic transactions. They are also behind the emergence of powerful screen-based worldwide markets in finance and the ever-widening impact of dominant cultural forms transmitted by television, film/video, video-transfer and consumer goods. Through these, media globalisation brings the different national situations and cultural forms closer together. Globalisation both homogenises and fosters a more culturally diverse world, in which we are more likely to encounter difference and 'a proliferation of specific identities', as the

Organisation for Economic Co-operation and Development (OECD) noted recently (Michalski et al. 1997, pp. 12–13).

Globalisation and the economy

In the economy, globalisation is uneven and partial. The growth of global activity does not mean the extinction of national economic networking. Finance and markets have been globalised to a greater extent than has production, and systems of industrial innovation remain predominantly national in character. In a study of patenting activity, Patel (1995) notes that most of the internationally located production of technology is actually the adoption of parent technologies, controlled by global companies, to the different national markets in which they operate. Those parent technologies are normally the product of a particular national system. As such, their emergence and application to production are crucially dependent on the conditions applying in the parent national system, such as finance for investment, government industry policies, expenditures on research and development, managerial capacity, labour capacity, and education and training.

Significantly, the data on patenting activity show that high-tech products such as those used in computing, aerospace and electrical equipment are more 'nation-centred' and less internationalised than are medium-tech products such as cars and building materials. The 'nation-centred' character of high-technology production parallels the relatively nation-centred character of education and training, and of the system of industrial innovation. All of these activities embody human inputs that are context-specific, located within a complex web of cultural and institutional relationships. In a brilliant study contrasting mechanical engineering in Germany, Spain, France and Japan, Kohler and Woodard (1997) emphasise how the respective social values, markets, production and organisational systems are nationally integrated and distinct.

National innovation

Studies of successful industrial innovation in Japan, Korea and Taiwan point to the role of nationally specific policies and cultural factors. National education and training systems, including on-the-job training, are among the areas of *least* convergence and greatest national specificity—and are also reckoned as one of the key strategic elements in East Asian development strategies (see for example Mowery & Oxley 1995).

> *Technology is not easily transferable across countries but, on the contrary, is country-specific and rooted in skills, capabilities and knowledge which in turn are accumulated through time. Nations differ not only in the quantity of innovations introduced, but also in the methods by which these innovations are adopted and in their sectoral composition* (Archibugi & Michie 1995, p. 3).

In his historical review of national systems of innovation Freeman (1995) makes a similar point. He draws attention to the importance of the *linkages* between different parts of the national innovation system, and cites Michael Porter on the 'localised character' of competitive advantage. In a globalised economic framework with less industry protection, uncompetitive firms have less shelter than before. In a more open competition, the specific attributes of each national system are decisive in determining its position. The nation is the source of the technologies and of the skills (education and training) that underpin competitive advantage. As Freeman notes:

> *Differences in national economic structures, values, cultures, institutions and histories contribute profoundly to competitive success. The role of the home nation seems to be as strong or stronger than ever* (Freeman 1995, pp. 17–18).

Globalisation and education and training

So the global picture is one of both closer networking, inter-dependence and mutual effect, *and* also local variation in which the nations and their differences are more visible to each

other than before. Those differences are central to the way nations influence each other, learn from each other and compete with each other. Globalisation also makes life more complex, creating many new strands of relationship and spheres of possible activity. In education and training, different institutions in the same country and same sector can respond to it in more than one way. Some might engage closely with international education of foreign students, others might be engaged in staff and student exchange, or collaborative cross-border training and research, or in preparing students for global business employment, or simply be more sensitive to communications technology and to cultural diversity in the classroom and at the workbench. Some might integrate their activities closely with industry players expanding into global markets, others might focus more generally on preparing trainees in the attributes necessary in a globalised world.

In his study of the impact of globalisation in the North American community colleges, Levin (1998) draws attention to the variation in strategic responses and variations in the degree to which institutional strategies are integrated with those of government and industry. These data underline the points that both globalisation and the response to globalisation are not 'fixed' or 'given'. Globalisation is a varying, changeable set of processes and forces which must be taken into account, but one which leaves much room for manoeuvre. It is also one which we help to create by our own efforts. In a very real sense, we 'make' our own globalisation. The environment shapes the behaviour of the actors within it, but those actors also help to shape the environment. Likewise technological change and growing industrial competitiveness—processes that are associated with globalisation—are not merely conditions that are 'given'. They are also created, modified and interpreted by human agents (Auerbach 1988, pp. 57, 112).

Competition and technological change

A survey of the managers of leading Australian companies, reported by Tegart et al. (1998b, p. 20), shows that international competition and technology are regarded as the major forces shaping their industries (table 2).

Table 2: Major forces shaping industry: results of a survey of leading managers, Australia

Q. What are the major forces shaping your industry?	Agriculture/ Mining/ Infrastructure	Manufacturing	Services	All industries
Proportion who mentioned:	%	%	%	%
International competition	24.5	32.7	18.5	25.5
National competition	7.5	11.7	17.6	12.5
Technology	15.0	18.1	29.7	21.2
Skills	12.2	10.0	15.0	12.3
Costs	21.9	14.8	11.3	15.6
Regulation	11.3	10.0	8.0	9.7
Other	7.8	2.7	0.0	3.2
Total	100.0	100.0	100.0	100.0

The views of leading global companies are not necessarily representative of Australian industry as a whole. But few sectors of the economy are untouched by extended and intensified competitiveness, transmitted by a partly deregulated global finance industry; and no sectors are unaffected by the accelerated rate of technological change. In particular, the generic information and communications technologies have altered management and work organisation in every sector. Many analysts argue that we are experiencing a new era in industrial development. Following the OECD, Sheehan and Tikhomirova (1998b, pp. 30–5) refer to the rise of the 'global knowledge economy'.

In economic terms the central feature of the information technology revolution is 'the ability to manipulate, store and transmit very large quantities of information at ... almost zero marginal cost for many users'. The Internet—which achieved full functionality only in 1993 when it had less than two million users in July of that year—is expected to have 500–600 million users by the year 2000. The use of micro-processors is now general, creating economies of scale, and also economies of scope in that they enable producers in some industries to provide a wider range of goods and services. They also greatly facilitate marketing.

Changes in work organisation

Kohler and Woodard note that in all four countries in their study the introduction of computer technologies is associated with far-reaching changes in work organisation. There is both a greater segmentation of production and use of outsourcing, and stronger integration and networking. Everywhere, functions such as planning, logistical support, maintenance and quality assurance became more closely integrated, job assignments become more flexible and local units take on greater responsibilities (Kohler & Woodard 1997, pp. 75–6).

Antonelli and Marchionatti (1998) note in relation to the Italian cotton textile industry that since the late 1980s new information technologies have been associated with profound changes in both organisational structures and skills. There is great scope for productivity improvement across the production–realisation chain, though it has taken a while to be realised.

Firms able to adopt information technologies successfully have access to suppliers around the world; reduced inventories; reduced paper-work; can implement standardised quality controls more effectively; are more flexible as to the location and size of individual production units and the use of sub-contracting; can more effectively customise production to meet needs and to do so more quickly; have greater scope for collaboration between firms within the industry; and are more co-ordinated in all respects. Market relations are strengthened by electronic communications, and 'bureaucratic co-ordination' is replaced by 'a mix of co-operative relationships implemented by on-line communication systems' (Antonelli & Marchionatti 1998, pp. 11–13).

The benefits are not automatic. New information and communications technologies must be paralleled by the achievement of closer interaction between production, marketing, finance and strategic decision-making, and higher levels of vertical integration and product diversification. There must be a high level of complementarity between changes in the different parts of the technical and organisational systems, and their interface:

> *When a complex new technological system emerges, a cumulative process of growth is likely to take place along with the introduction of new complementary innovations, in products, processes and organisations, so that their effect on overall productivity levels becomes apparent only with significant delays. Complementarity requirements between innovations are key factors for assessing the overall levels of productivity generated by the adoption of each technological innovation. Only when the appropriate mix of complementary innovations is available can the full effects in terms of productivity growth be achieved. Information technologies have generally very high requirements in terms of interrelatedness and complementarity and are consequently likely to display their effects fully only when the full set*

of complementary and interrelated organisational and production changes have been made (Antonelli & Marchionatti 1998, p. 11).

In the Italian cotton industry the introduction of new technologies has been associated with a binary division of the industry, between six large multi-nationals with mobile plant, vertical integration and product diversification, and many small specialised firms, mostly bound to Northern Italy and slow to adopt the new techniques. The 'full set' of changes is accessible only to the large firms that can bear the cost of 'the complex organisational changes necessary' to exploit the new technologies' scope for productivity improvements and carry the long delays before benefits appear.

Firm size is not the only factor. The diffusion of the new technologies is also 'strongly influenced by the learning opportunities which make it possible to acquire specific skills and consequently to elaborate new procedures and new organisations both among and within firms'. Further, the new communications systems enable the externalities deriving from successful technological breakthroughs to be maximised. This emphasises the importance of policies that facilitate screen-based networking throughout the industry, and also of training that is 'able to supply the markets with high levels of skilled manpower that speeds up the adoption within small and medium-sized firms, especially in backward regions' (Antonelli & Marchionatti 1998, pp. 11–12, 17). By collaborating in industry networking and training, under the auspices of government, the industry can become more competitive on a world scale.

The two trends—digitally based information-oriented technological change, and the extension and intensification of competition—tend to reinforce one another. Information technologies facilitate management in its drive for competitive advantage, enabling better business planning and monitoring of stocks, and closer surveillance of workers to improve productivity (although at the risk of suppressing the capacity for larger initiatives). The information industry enables the networking of local branches which operate with a good deal of initiative while subject to central corporate control. Large and viable, decentralised corporations are able to spread competitive activity further, with increased local sensitivity, while also securing standardised efficiencies.

With the cost of acquiring information now so low, and with networked systems operating within an industry or sector—often across national borders—the rate of diffusion of new ideas has been accelerated, and all markets are increasingly volatile. Technological change in a networked and open economy speeds the process of displacement of old technologies, while the competitive penalties for companies locked into obsolete processes are now visited on them more quickly and more severely (Auerbach 1988, pp. 114, 269, 326–7; Antonelli & Marchionatti 1998).

The greater the speed, freedom and efficacy with which firms pursue projects in different spheres, the more competitive the economy.

The inexorable increase in the quantity of business information, the improvement in the quality and comparability of business data with the development of the accounting profession and the adoption of standards of reporting and the general improvement in communication of all kinds—all these factors, coupled with the progressive professionalisation of management have generated a long-term tendency for competitiveness to increase in the capitalist market economy (Auerbach 1988, pp. 57, 112).

Industrial innovation

'The ability to rapidly develop innovations of greater complexity with fewer resources has an increasing impact on firm success' (Thomke 1997, p. 105). This suggests that firms that are able to develop a capacity for *continuous* innovation, in work organisation as well as technologies, can secure an advantage. Metcalfe (1995, pp. 28, 32) states that the development of such a capacity is crucially affected by the extent to which the larger economic and cultural context of research, knowledge and skills enhances 'the learning process in firms and other institutions

so as to generate variety in behaviour'. Here 'learning' refers not only to formal research and development (R&D) conducted inside and outside the firm, but also to on-the-job training.

In many (although not all) industries the rewards for successful innovation are great, more particularly in industries operating at the cutting edge of growth sectors such as information and communications, where economic competition has a relatively high positive-sum rather than zero-sum element, and there is maximum scope for the creation of new products and new markets. Nevertheless, by no means every firm is an innovator, even in those sectors. Geroski et al. (1997) study innovation behaviour in British firms. Innovation is understood in terms of new processes and product lines generated through R&D or the purchase of machinery. They find that the notion of firms in a 'knowledge economy' continually absorbing new knowledge and using it productively is true in practice only for some firms and for most of those, only some of the time. For firms that *do* innovate successfully, it is mostly a one-off, generating a pattern of innovation/exploitation of innovation/stagnation.

For most firms, successful innovation largely consists of the adoption of new technologies and work processes from elsewhere. But there are still costs in terms of investment in human and physical capital. As Antonelli and Marchionatti note there are time-lags before output returns to its previous peak, creating earnings forgone. When more than one innovation is involved, it often pays to stagger their introduction, minimising down-time and under-utilisation during learning periods (Jovanovic 1995; Jovanovic & Stolyariv 1997). However, it should be emphasised here that the relationship between old and new technologies is not always one of conflict and displacement. Sometimes each can have a positive effect on the other. Alternatively, sometimes an emerging technology will have a negative effect on a mature technology, but the mature technology has a positive effect on the growth of the emerging technology (Pistorius & Utterback 1997, p. 72). Likewise, the skills associated with a mature technology may remain useful. Strategies based on *wholesale* destruction of the old technology and complete replacement of the associated skills can be counterproductive.

Innovation and size

Evangelista et al. (1997) study innovation in Italian manufacturing. Only one-quarter of firms with 50 employees or less are innovating firms. The proportion rises sharply with increases in firm size. This reinforces the findings of Antonelli and Marchinatti (see also Crepon et al. 1998, p. 2). Howell and Wolff (1992, p. 141) corroborate the association between firm size, innovation capacity, technological change, and higher skill use. The generalisation about the relationship between firm size and the capacity to innovate does not hold in all industries. In the information and communications technology industries themselves, small firms often play a dynamic role. For small firms in most other industries, however, the settings are less favourable. Yet it is smaller firms where employment growth is more likely to occur. This suggests a binary industrial landscape divided between self-reproducing, technologically sophisticated large firms that shed labour, and technologically backward small firms that carry the main employer function but have difficulty sustaining themselves. This highlights the need for targetted government intervention to maintain the financial viability and technological readiness of small firms; for example, through policies on training and research.

Industry and skill composition

Employment in primary and service industries

All industrialised economies have experienced a substantial reduction in employment in primary industries and manufacturing industries as a share of total employment, and the continuing growth of employment in services. Between 1966 and 1993 in Australia, the share of employment located in goods-producing industries fell from 46 to 29 per cent. The share of employment that was located in goods-related services industries did not change. Employment in the person and knowledge-based services rose from 25 to 41 per cent. The number of people employed in goods production rose by a bare 15,000, the number in the

people and knowledge-based services from 1.2 to 3.2 million (Dunlop & Sheehan 1998, pp. 206–7). There are similar trends in the United States. These patterns have led many analysts to conclude that we are experiencing a simple displacement of manufacturing industries by services industries, constituting a 'post-industrial' economy, in which manufacturing will be automated and services will be the site of employment.

The reality is not so simple. Services as a whole are more labour-intensive than manufacturing, but that does not mean manufacturing is less economically important. There are trends to technological displacement of labour in services as well as manufacturing. Trade in services is expanding significantly, but alongside, rather than in place of trade in manufacturing. Productivity in manufacturing remains crucial to international trade and competitiveness. The picture is more complex given that the role of goods-related services, and changes inside manufacturing itself, have blurred the manufacturing/services boundary. Many services firms are focussed on providing services to manufacturing firms. In Australia over 60 per cent of the inputs from other industries to the production of elaborately transformed manufactures (ETMs) are from services. Pappas and Sheehan argue that:

> *An integrated manufacturing-services sector—integrating the vast range of services now required to develop, produce, market and distribute industrial goods and services on a global basis—is the most dynamic sector of many economies* (Pappas & Sheehan 1998, p. 129).

They conclude that industry policy should focus on the development of 'clusters of production and services activities, which are jointly competitive on a world scale'. Within manufacturing industries, the services functions have become more differentiated and complex, and absorb a growing share of total manufacturing employment. More than one-third of all jobs within Australian manufacturing are in service functions such as planning, design, accounting, training, marketing and quality control. Between August 1987 and May 1995, managerial and professional staff jumped 17.3 per cent, other white-collar staff increased 8.2 per cent, while there was a fall of 11.1 per cent in production personnel.

The proportion of all manufacturing labour who were production personnel fell from 70.8 to 65.6 per cent, with a considerable decline in plant and machine operators and tradespeople. With little change in the number of labourers, there was a deskilling of production personnel overall (table 3). The trend to service occupations in manufacturing occurred despite the outsourcing of many activities. There were similar although not identical trends in the USA. (Pappas & Sheehan 1998, pp. 129–32, 143–7).

Table 3: Occupational distribution of manufacturing employment, Australia, 1987–1995

	August 1987	May 1995	Percentage change
	Thousands	Thousands	%
Managerial and professional	**168.6**	**197.8**	**17.3**
Managers and administrators	79.2	91.0	14.9
Professionals	64.4	72.1	12.0
Para-professionals	25.0	34.7	38.8
Other white-collar	**167.8**	**181.5**	**8.2**
Clerks	122.9	127.1	3.4
Sales and professional service	44.9	54.4	21.2
Production personnel	**815.0**	**724.4**	**- 11.1**
Tradespersons	346.5	299.4	- 13.6
Plant & machine operators and drivers	217.1	172.3	- 20.6
Labourers and related workers	251.4	252.7	0.5
All manufacturing	**1151.4**	**1103.8**	**- 4.1**

Employment and technological change

The long-term net employment effects of the current wave of technological change remain an open question, with the balance of the argument perhaps favouring net job loss. Within computing, the employment trend is downwards: between 1984 and 1995 the American computer industry lost one-third of its workforce (Warnke 1996, p. 18). On the other hand, there is significant growth in industries such as property and business services, tourism and hospitality, and culture and recreation, which have all been strongly impacted by new technologies (Tegart et al. 1998b, p. 11).

The long-term effects on skill composition are also an open question, with the balance perhaps favouring upskilling. However, net data are of limited explanatory value, given that there appears to be a greater polarisation between low-skill and high-skill jobs. Some of the work associated with new technologies requires more substantial intellectual skills than before, some of it is smarter work in which the machine rather than the worker carries most of the additional skilled content, and some of it is routine by any measure; for example, repetitive data input.

Skill needs and technology

In their insightful study of American industry Howell and Wolff find that the share of professional and technical workers in industry employment is growing fastest in those industries undergoing the most rapid technical change. Empirical tests conducted by the authors suggest that computerisation is associated with a growing demand for cognitive skills. 'Computer intensity, young capital stock, and high shares of engineers and computer specialists are all positively linked to cognitive skills growth', although they are also associated with declining interactive skills (Howell & Wolff 1992, pp. 128, 142–4).

Looking across the whole of American industry, Black and Lynch (1997) find that firms that made communications skills a priority in recruitment performed better than average in the 1988 to 1993 period. On the other hand, there is the relative increase in the weight of low-skilled work within the blue-collar functions in Australian manufacturing (table 3). Broad-brush data indicate that in the 1980s, in all OECD countries, white-collar work grew relative to blue-collar work and in most countries the number of blue-collar workers declined in absolute terms. (The USA was one of the few exceptions to the latter trend).

In OECD countries the fastest growth was in the white-collar high-skill jobs. At the same time, blue-collar high-skill jobs declined substantially, and more so than blue-collar low-skill jobs, except in Germany, where high-skill blue-collar work increased, and Italy, where there was a similar decline in both kinds of blue-collar work. Some analysis of data from Australia and the USA suggests the increase in low-skill white-collar work might be large enough to ensure no net increase in skills overall (Dunlop & Sheehan 1998, p. 231–40).

Workforce skill composition

But these data are very broad indeed. Measuring overall changes in the skill composition of the workforce is difficult. A number of different methods are used, none of them entirely satisfactory. First, trends in the occupational structure are quantified, as in table 3, and these trends read as proxies for trends in skill use. The problem here is the assumption that the skill content of occupations is constant. The second method is to proxy trends in skill by using trends in relative earnings, but these data are contaminated by the many factors other than skills which affect the level of earnings. The third method is to track detailed trends in the skill profile of particular occupations, weighting the outcomes with the trends in occupational and industry distribution (Dunlop & Sheehan 1998, p. 229). However, this requires a micro-analysis of skills in the various occupations. Such data are not always available in one-off (let alone longitudinal) form.

Pappas (1998a) analyses trends in skill requirements using three facets of skill: cognitive, interactive and motor. He allocates a skill loading on a scale of 1–10 to each of the occupations in the standard ASCO classification used in Australia. The skill loadings are imported from the US *Dictionary of occupational titles*. He is unable to track changes in skill requirements directly; instead, he reads them from the changing occupational distribution, as outlined above. He finds that between 1976 and 1995 there was a trend increase in the mean cognitive and interactive skills of employed persons in Australia, which accelerated in the second half of the 1980s, largely as a result of change in the occupational mix of employed persons within industries (intra-industry change).

There has also been a trend decline in the use of motor skill. 'The mean interactive and cognitive skill levels increased by 11 per cent and 4 per cent respectively between 1981 to 1991, while the mean motor skill declined by 8 per cent' (Pappas 1998a, pp. 255, 268). Using regression analysis, Pappas concludes that there are significant positive correlations between intra-industry changes in the use of skilled labour, and various indicators of technological change. 'Cognitive and interactive skill complement new technology' (p. 255). Communications and control technology draw heavily on those skills. It appears that, while information technology is associated with a declining use of motor skills, this is less true of other technologies (p. 282). Most of the change in skills has been driven in the domestic consumption sector, not the export sector. He also finds that, for male workers between 1986 and 1991, average earnings for interactive skill increased faster than earnings for cognitive skill, and still faster than earnings for motor skill. 'Overall, the employment and earnings prospects of Australian workers who do not possess a high level of cognitive or interactive skill do not appear very positive' (p. 290).

Australian imperatives

The current context

The various contributions to Sheehan and Tegart's *Working for the future: technology and employment in the global knowledge economy* (1998) find that, in a more open, competitive and technology-driven global economy, the Australian economy is well placed in some respects, less well placed in others. The strengths are a strong knowledge base relative to population size, a relatively open society and internationalised economy and culture in close proximity to East and South-East Asia, a genuine presence in some high-technology, export-oriented industries, and the rapid recent diffusion of new information and communications technology. Australia is in a strong position to enter the emerging online economy. It has a 'good telecommunications infrastructure and a skilled software industry', and the eighth highest PC penetration in the world with 240/1000 in 1995. There is a range of competitive industries including agriculture and mining, and parts of manufacturing and services (Sheehan & Tikhomirova 1998a, pp. 101–3).

The weaknesses are the traditional ones. Australia has a small indigenous capital base and characteristically small firm size. In addition, the traditional compensating mechanisms—foreign capital inflow and selective intervention by government—have faltered in recent years.

Trade and export

The overall balance of trade on goods and services has moved from a deficit of 4 per cent of gross domestic product (GDP) in 1982–83 to a small surplus in 1996–97. One area of progress is the growth in services exports. Between 1987–88 and 1997–98 services exports rose by 9.7 per cent per year while services imports rose by 7.6 per cent per year. Another area of progress is 14.2 per cent annual growth in exports of elaborately transformed manufactures (ETMs) over the same period compared to overall growth of 7.8 per cent in exports, and 8.1 per cent in imports, and 8.7 per cent in imports of ETMs. Nevertheless, at $65.6 billion in

1997–98, imports of ETMs still exceeded exports of $16.6 billion by a factor of three (Sheehan & Tikhomirova 1998a, pp. 120–2).

At approximately $200 billion foreign debt is also a constraint, although it appears to have stabilised. Globally, trade is shifting in favour of higher value-added, high-technology goods, even though other goods remain more important overall. In this spectrum Australia is at the low valued-added end but its position is improving. Of the high-growth, high-technology areas seen as priorities for development, Australia is strong in science-related biotechnology and genetics, and has niche strength in information and communications technologies and transport, but is weak in precision and control in manufacturing, and new materials (Tegart et al. 1998b, pp. 12–13).

Impact of firm size

The underlying problem is that the nation lacks productive capacity in many areas of industrial activity. Many Australian firms are very small relative to the scale necessary to achieve international competitiveness. In 1994–95, 93 per cent of Australian firms had less than 20 people. Only 27 000 firms had 20 or more. Productivity increases sharply with size, especially in manufacturing: gross product per head in firms with more than 100 people is more than double that for firms with 5–19 people. The firm size distribution in Australia resembles Spain rather than Germany or the USA. Only about 2.5 per cent of firms with less than 20 employees exported in 1994–95.

The particularly Australian problem is not just the heavy bias towards small firms, but that the *large* firms tend to be unusually poor exporters. Many of them are local branches of multinationals, whose focus in Australia is on working the Australian market rather than on R&D and product development in relation to global markets. Further, Australia has failed to attract its share of the recent upsurge in foreign direct investment, especially for the creation of new productive capacity rather than asset purchase (Sheehan & Tikhomirova 1998a, pp. 101–7, 117).

Thus the normal relationships between firm size and innovation are reversed in Australian manufacturing. Among firms undertaking R&D, the level of R&D and innovation spending as a share of sales is *five times higher* for firms of less than 10 employees, than for firms with 500 or more employees. This is partly because 46.7 per cent of firms with 500 or more employees are at least partly foreign owned and a third of these are at least half foreign owned. 'The foreign share of sales is particularly pronounced in higher technology industries—being 56 per cent in the high R&D intensity category and 61.4 per cent in the medium high category'.

A number of small Australian companies in the high-tech sector are going very well, partly thanks to the export development policies of the later 1980s and early 1990s. But the big firms dominate high-tech production, and from the national viewpoint they are poor performers. There are similar problems in the medium-technology industries such as motor vehicles and chemicals. These are low R&D and export performers. Two-thirds of the sales are controlled by foreign firms (Sheehan & Tikhomirova 1998a, pp. 107–111). One outcome is that Australia is applying new design and production technologies at half the American rate and also lags behind in training of the appropriate skills. Government has focussed largely on creating the conditions for open global competition instead of remedying capacity deficiencies.

The processes of adjustment in firms and government agencies have largely been through external means (retrenchment, contracting-out, downsizing, use of temporary employees, privatisation and sales of businesses) with less attention having been given to the retraining and redevelopment of capabilities within the firm (Sheehan & Tikhomirova 1998a, p. 102).

This strategy neglects the fact that the 'competitiveness of Australian firms will be a function of their technologically sophisticated workers' (Tegart et al. 1998b, p. 4).

Post-Fordism?

Idealist notions of a 'post-Fordist' social/cultural landscape exercise a powerful hold on sections of the literature and sometimes seep into policy thinking. The post-Fordist literature, which is centred on manufacturing processes, intersects with arguments about 'post-industrial' society, the 'knowledge society' and a new 'information age' centred on the services sector, arguments which have a similar Utopian cast. The common vision is of a high-skill, high-trust, more flexible, less hierarchical and highly networked economy characterised by small batch production customised in line with diverse consumer demand, multi-skilled workers with regular on-the-job training, and greater scope for choice and initiative. In the post-Fordist vision, work is organised in small, mobile organisations that are readily combined and realigned at need.

Yet the data provided earlier showed that in most industry sectors, large firms have substantial advantages over small firms when it comes to innovation and technological change. This severely qualifies the post-Fordist idea of a world in which the cutting edge is occupied by small, flatly structured firms involved in continuous change. Ironically, it is more likely that, to the extent they have developed, post-Fordist features are found within the networked structures of larger firms in which the capacity for local initiative is underpinned by long-term investment horizons, access to financing, and advanced resources in management, marketing and training.

In a more networked and information-heavy world, company size and mass production still matter. American industry maintains high productivity and competitiveness, not because it has made a sudden transition to a myriad of small batch niche producers, but because the sheer size of the American domestic market allows industry to combine advanced levels of product differentiation based on customised specialisation, with Fordist-driven efficiencies and planning. The increased information potential of computers provides powerful new tools for centrally controlled Fordist operations. At the same time, the wide range of market opportunities sustains a culture of responsiveness and flexibility that partly compensates for Fordist rigidity in production. As part of this capacity for flexibility, American manufacturing uses extensive informal on-the-job training at need.

USA clothing industry

The real industrial world is comprised of a mix of recognisably Fordist and post-Fordist characteristics. Industrial capitalism is still industrial capitalism, and there are sharp distinctions between the quality of work in different jobs, distinctions which the post-Fordist imagination passes over. As Taplin (1995) remarks in his study of the American clothing industry, flexible production technologies and labour process organisation co-exist here with '"rigid" low-skill, low-paid workers'.

The pressures towards greater market segmentation, the need for shortened product development cycles and greater operating flexibility, plus intense low-wage competition, encourage the use of microprocessor technologies and this is consistent with some of the post-Fordist vision. But flexible specialisation often masks intensification of effort. Managers define flexible production as a way of lowering costs and becoming more responsive to the market 'without making significant investments in worker training and job enrichment'. In this new/old workplace there is heightened pressure on management and workers alike. The garment industry is unhappier than most, but the point that Taplin draws out is that here the agenda is *not* being set by autonomous multi-skilled workers.

Technology—the driver of change?

Stanworth (1998) argues that much of the post-Fordist and associated arguments are 'technologically deterministic, with the assumption that technology is an irresistible driver for progressive change'. These arguments imply that, on one hand change is inevitable, on the other there are only two choices. Either there is a slow take-up of technology resulting in lost competitiveness, economic deterioration and growing unemployment, or, if the right decisions are made now, the future will be bright: the 'information superhighway' will carry us automatically to a rosy future, an 'age of plenty' with greater diversity in household and cultural goods, cheapening products and exciting new job opportunities.

In terms of labour, the discussion focusses on innovative ways of working, such as telework, telecommuting, call centres and telecottages, 'with the workforce "freed" by the technology from the constraints of location and time'. Teleworkers are separated from the specific workplace information and communications technologies. Alternatively, they may be core employees with privileges and power, autonomy and high trust positions. 'Popular writing stresses the freedom which the technology gives to workers to determine how and when they work'. The discussion of information age work mostly focusses on professional, technical and managerial workers, Reich's 'symbolic analysts'. There is little acknowledgement of more routine jobs such as data entry, word processing and telesales. Job displacement through automation is ignored.

In this all-too-rosy picture, work organisation is conceived as a loose web of individuals, capital and technologies, project-focussed, structured by changing collaborative networks regulated by contracts and competition. 'Market relationships of short duration between self-employed individuals are considered superior to all other forms of employment, particularly in the US literature' (Stanworth 1998, pp. 52–3)—more dynamic, efficient and adaptive than any other relationships. Here the post-Fordist literature is a poor guide to policy-makers, or practitioners in VET. For example, it is true that a growing proportion of jobs are detached from the old forms of wage labour. Some are characterised by autonomy, opportunity and substantial earnings. However, many are poorly paid, with little scope or creativity in the work, or opportunities to perform it, and with *less* training, reskilling and industrial protection than traditional wage labour has offered.

The trend to faster rates of innovation is very clear. The post-Fordist emphasis on technological change, and on the interrelation between industry structure, work organisation and the nature of work in a high-technology world, are right. But the reality of work organisation and labour is less attractive, and more uneven and fragmented, than post-Fordism imagines. Technology will not construct a better future on our behalf, in the manner of machines reinventing themselves *ad infinitum*. The hard choices about government policies and structured training programs will still have to be made.

Work cultures and organisation

Thomke (1997, p. 117) asks why more firms do not make better use of the flexibility offered by new technologies and systems. He suggests that it might be 'for the same reasons they fail at innovation in general: increasing flexibility requires a departure from old organisational routines and design knowledge—a challenge that has proven to be quite difficult for many organisations'. Pappas (1998b) notes that public policy on technology diffusion needs to be broadened to include diffusion of capacity in strategic organisation and the management of change in workplace practices. It takes time for firms to learn the new routines that deliver rewards in a novel environment. Reducing that time is a source of competitive advantage. It is crucial to make use of all personnel in organising change.

Productivity and workplace practice

Black and Lynch (1997) make the point that, while there have been many studies of the effects on productivity, of R&D, human capital and physical capital, few of these have taken into account the impact of workplace practices. They find that the element associated with higher productivity is not so much whether a particular work practice such as total quality management (TQM) is adopted, but *how* it is implemented in the workplace. They emphasise that 'practices that encourage workers to think and interact in order to improve the production process are strongly associated with increased firm productivity' (pp. 3–4). They find that plants in firms involved in 'transformed' industrial relations practices that promote joint decision-making plus incentive-based compensation have higher productivity than other plants. As noted, they also find that higher productivity is correlated with educational level and computer use. It may be significant that both of these mechanisms facilitate participation, and the flow of shared information throughout the workplace.

Nevertheless, there is no one single set of rules for work organisation and changes in workplace practice. These factors are highly specific to national and regional cultures, and to the traditions and techniques of different industries. Generic formulae *must* be supplemented by a grasp of these specifics, or re-organisation is bound to fail. For example in his study, 'Dynamics of Asian workplaces', Hong (1997) draws attention to a greater role of group factors in productivity advance, as distinct from individualistic factors. Performance-based remuneration is unattractive in Japan because of the 'shared feeling that co-ordination and harmony among group members are critical to human relations within workplaces' (pp. 7–8). In China interpersonal ties based on *guanxi*, bonding between two or more individuals whether tied by kinship or not, are important.

Worren and Koestner (1996) interview personnel managers in each of Norway and Canada. Both groups placed a high value on employees who can adapt to change and generate new ideas, both express preferences for national cultural factors, and both emphasise team orientations. There is one important variation between the two countries: co-operativeness is valued especially highly in Norway, but not in Canada.

Teams and workplace practice

In this respect Canada probably has something in common with Australia. Park et al. (1997) examine the development of flexible decentralised teams in the Australian auto industry. Though 50 per cent of the companies set out to create self-managed work teams with 36 per cent requiring semi-autonomous 'directed' work teams, what emerged was directed work teams in 61 per cent of cases. Only 17 per cent created self-managed teams. Functions most likely to be decentralised included daily production-tasking, day-to-day quality control, job rotation, managing unplanned absences and communicating with other teams (p. 785).

For the most part, responsibility for training was *not* delegated to the teams. It was shared between team and management in 34 per cent of cases, and managed by the teams themselves in only 11 per cent of cases. Thus the potential for a reflexive culture of training, in which work groups monitor their own skill needs and deploy resources to deal with those needs, was limited. Significantly, although the reforms to work organisation were associated with improvements in quality, productivity and timeliness, positive correlations with employee attitudes and behaviours were less widespread.

Highly individualised cultures are common to all of the Anglo-American countries, including Australia. It may be this inhibits the potential of team approaches, reduces the scope for trust-based devolution and slows the pace of workplace change. If so, these Anglo-American cultural factors need to be taken into account—and compensated for—in programs of strategic change, and also programs of training for strategic change management.

Job integration and organisational change

Kohler and Woodard (1997) found that the more advanced sectors of industry are those which have moved away from a Taylorist division of labour based on limited skills and the inhibition of initiative and capability. In Germany there is a relatively low level of functional differentiation (the separation of planning and service functions from the shop floor) and task differentiation (confinement to single production tasks). The result is stronger ties of co-operation than in France, where both functional and task differentiation remain high.

Sels (1997) compares new production concepts in the auto, clothing, chemical and machine tool industries of Belgium. He measures the extent of 'deconcentration' and 'job integration', whereby supporting and preparatory staff services such as planning, programming, quality control, maintenance, quality assurance, personnel, are integrated into the production departments; staff services are trimmed; staff and production departments are merged and staff services assigned to line management. He finds that of the four industries, one—the machine tool industry—has moved decisively in this direction, though as yet only the more routine programming functions are fully integrated into operator jobs.

Thomke (1997) makes the incisive comment that 'organisational interdependencies' affect the costs of organisational change. If every sector of the organisation is affected by every other, to change one sector it becomes necessary to transform all. He suggests that 'design flexibility can be enhanced by developing a design architecture that minimises interdependence between its individual components' (p. 117). Likewise Sels (1997) focusses on a 'product-oriented' approach, whereby individual workgroups, integrating operational and service functions, take responsibility for discrete product lines. Products can be supplemented or detached without disrupting the whole organisation. The change management literature tends to talk about change in holistic terms. It is true that networking change—change designed to bring every corner of an organisation into the common systems—is holistic in character. From time to time, too, holistic cultural change is needed. But for change to become routine and *ongoing*, it must be managed in such a way that down-time is minimised and energy is conserved.

Flexible and contingent labour

Working 'flexibly'

The term 'flexible work' is ambiguous. On one hand, it is used to refer to forms of self-employed or temporarily employed work in which the employee enjoys a high level of autonomy, creativity and mobility. This is the archetypal, high-tech professional, with choices about what to do and where to work, underpinned by good and sometimes lucrative remuneration. On the other hand, it is used more generally to refer to the fragmentation of the older norm of long-term, full-time work for a single employer, often in a single location. In this form 'flexible work' includes the trends to the greater use of part-time work, non-standard hours, casual labour, home-working, self-employment and contracting out. In these cases, the flexibility benefits the employer more than the employee. The move away from standard work enables employers to hire and fire more readily, reduce the level of job benefits and evade training costs.

Most 'flexible 'employees are such only because they have no choice. There is also a third category of workers who might prefer to work part-time or non-standard hours, but without greater insecurity and reduced benefits. The term 'flexible' covers more than one kind of outcome and it is foolish to embrace or reject it *in toto*. However, the Utopian post-Fordist use of the term 'flexible' tends to confuse rather than illuminate the complexity of the contemporary restructuring of work.

In their important study of work in Silicon Valley in California, Carnoy et al. (1997) waver in their use of the term 'flexible'. They note that most non-standard jobs are low-paid or marked

by poor working conditions. On the other hand, they argue, in Silicon Valley a significant, although still small minority of such jobs provide opportunities and enhanced conditions, though at the cost of increased risk. They also identify some forms of flexible work which are 'contingent' in the sense of entailing reduced, tenuous or indirect ties between employer and employee. Yet, because some workers prefer part-time work, and because in other cases worker disadvantage is not inevitable, flexible should be retained as a universal term. This is problematic. It would seem better to use 'flexible' for those situations where the flexibility is genuinely mutual, and 'contingent' where the benefits are assymetrical and favour the employer. That is the approach taken in this paper.

'Flexible' work in the USA

Carnoy et al. include under their heading of flexible work the hiring of individuals through temporary employment agencies; the hiring of individuals on a temporary, contract or project basis; part-time work; certain forms of self-employment; informal employment on a day-labour basis or in the home; and forms of sub-contracting where the work is controlled not by the sub-contracted firm, but the form controlling the contracting (p. 24). In Silicon Valley the incidence of part-time work is no greater than elsewhere in the USA, but employment via temporary help agencies has grown to 3 per cent, compared to 1 per cent in the rest of the country. Trends in informal day-labour, home-working and sub-contracting are difficult to measure. There has been a huge rise in employment in business services such as computing, data-processing, credit reporting, advertising and so on, and much of this work is sub-contracted. The authors estimate that between 27 per cent and 40 per cent of all employment in Silicon Valley is flexible or contingent and that in the last decade more than half of the total growth in employment falls into these categories.

Edwards and Field-Hendrey (1996) review data on home-base work in the USA as a whole. Almost one worker in five take some work home but the majority are not paid for it. Less than 2 per cent of all workers work 35 hours per week or more at home. Comparing home-workers to the workforce as a whole, in the former category, personal services work and farming are over-represented. Home-workers are more likely than average to be self-employed, and to be managers or professionals. Hourly earnings are 85 per cent (men) and 75 per cent (women) of those of their on-site counterparts.

'Flexible work' in the UK

Stanworth (1998) discusses 'teleworking' in the UK. Some teleworkers are on-site employees who are home-based for part of their working week. They tend to be male, highly skilled and enjoying status, autonomy and trust. Others are full-time employees with fewer options. Moving between clients, they have lost a permanent desk space at work ('hot-desking'). 'A variation is "hotelling" where client companies provide workers with access to computer networks and office facilities, rather than the employer' (p. 57). Those who are home-based for all of their working time and working for one employer are generally women doing low-skilled clerical work such as data entry, typing or questionnaire encoding. Some are doing more skilled work. They are often treated as self-employed and (poorly) paid by results. This kind of routine back office telework appears to be expanding.

Another category comprises freelance workers working from home, often former employees who have been 'downsized'—a low-cost, skilled or semi-skilled resource. Mobile telework seems to be on the increase. It augments the productivity of the travelling salesperson, or household service industry worker who are provided with daily schedules straight into the van. Teleworking on remote sites includes call-centre work with customer interface; for example, in banking, where companies can tap into married women seeking local part-time employment. Typically this work is low-skill, and it often includes shift work and night work. Stanworth notes that staff remote from the workplace—whether in low-skilled work or professional and technical work—are more vulnerable than conventional staff to erosion of their conditions of work, and may have fewer opportunities for job enhancement and promotion. They are 'excluded from social dialogue'. Home-based and mobile telework and

'hot desking' enable firms to reduce costs by the disposal of office space and there is an increase in offshore telework in cheaper locations. It is 'when women and men have skills or experience which is in short supply' that 'telework can be liberating and well-rewarded'. Most teleworkers have a different experience (Stanworth 1998, pp. 57–9).

'Flexible work' in Australia

Lafferty et al. (1997) summarise the available data on home-working in Australia. These data tend to exclude people working informally or illegally, for example by evading tax—overseas students, many legal and illegal migrants—and tend to underestimate the incidence of women and non-English-speaking background workers. Lafferty et al. reinforce the point that home-work, facilitated by computerisation and telecommunications, can be both more flexible from the worker's point of view, or more exploitative. Relationships based on sub-contractors or other intermediaries are often designed to evade legal provisions providing for employee rights.

In 1995 there were an estimated 343 300 home-workers, 4 per cent of the workforce. The number had grown by almost a third since 1989. In fact, 11 per cent were employers, 37 per cent paid employees, and the rest were self-employed, paid in kind or unpaid. Women were two-thirds of all home-workers, and people aged over 55 were over-represented. One-third of male home-workers were professionals and another 22 per cent were tradespeople. However, only 13 per cent of women home-workers were professionals, with 6 per cent in trades. The largest single group was clerks in the construction industry, almost all of whom were female. More than two-thirds of all home-workers were casual employees, compared to 24 per cent of all workers. Only 3.7 per cent of home-workers were union members in 1995.

Data prepared by Le (1995) indicate that in 1994, 1.2 million Australians were self-employed, constituting 15 per cent of the total workforce. Early school-leavers, people working in the primary and construction industries, managers, professionals, and those working in the 'skilled vocational' occupations, were over-represented. Between 1978 and 1994 there was little change in the incidence of self-employment.

However, Dunlop and Sheehan (1998) record a major growth in the incidence of part-time work in Australia, and in non-standard hours. As a share of the working, aged population, full-time work fell by about 20 per cent in the 1973–98 period. The proportion of people in part-time jobs tripled in that time. Although 'full-time work remains the dominant form of labour supply in the economy'—in August 1995 it still constituted 88.9 per cent of all hours worked—the trend away from full-time work is clear.

At the same time, more people than previously are working more than 45 hours a week, and more are working less than 20 hours a week. Between 1978 and 1995 the number of employed persons working a standard (30–44 hour) week increased by only 3.5 per cent. However, the number working 45–48 hours rose by 80 per cent, those working 49–59 hours rose by 142 per cent, and those working 60 hours or more rose by 206 per cent. Whereas in 1978, 15.6 per cent of all wage and salary earners worked 29 hours or less, by 1995 this group comprised 24.6 per cent of the workforce. As in other OECD countries, there has been no discernible trend to job sharing or other arrangements to spread the available work more equitably (Roche et al. 1996).

By 1995 over *half* of all wage and salary earners in Australia were working outside the 30–44 hour band and virtually all of the growth in wage and salary employment since 1978 had been in non-standard hours work. Most significantly, casual employees as a percentage of all employees rose from 15.8 per cent in 1984 to 23.8 per cent in 1997. Although the area is under-researched, some evidence suggests that higher labour turnover is correlated to reduced labour productivity (Black & Lynch 1997, p. 22; Lynch & Black 1995, p. 27). This is not surprising given that it is associated with lower rates of training, and lesser input from experience. The flexible economy, which is associated with intrinsic motivation, is no doubt

good for output. The contingent economy might seem like a good idea to employers mindful of costs and control, but it imposes new limits to the capacity of labour.

Inequities

Social inequities limit the potential contribution of labour to production, and they also limit the contribution of people's labour to their own wellbeing. The binary division between flexible labour and contingent labour is symptomatic of a larger problem: the gulf between the main beneficiaries of the new order, and the rest. The growing social inequalities are much discussed, but there is no macro-solution in sight. Lawrence (1997) notes that, in the United States, the gains made in reducing child poverty in the 1960s and 1970s have been largely reversed, while the gap in earnings between Afro-Americans and others has widened again. The leading 500 companies have shed a third of their labour force since 1980. Michalski et al. (1997, p. 8) notes that in a changing and unstable economic environment, a strong social fabric is needed, yet 'there is a strong sense of worsening social circumstances for large segments of OECD populations'. The most serious manifestation of inequality is unemployment. The labour contract is still seen as the foundation of social order and well-spring of individual fulfilment, but for many people it no longer performs those functions (Offe 1997).

Core/periphery model and social trends

Labour sociologists refer to the 'core/periphery' model of companies, in which a small permanent core group is joined to a shifting network of temporary employees, outsourcing and consultants. Dunlop and Sheehan (1998) identify a number of social trends that seem to be consistent with the core/periphery model: the rise in part-time and casual work and the growth of outsourcing, the increased dispersion of working hours, an increase in 'precarious' employment, growing regional inequalities, and the polarisation between families in which several people work, and families where no one works.

Between 1979 and 1995 the number of Australian families rose by 15.7 per cent (341 000). The number with no parents working rose by 73.5 per cent (175 000), the number with one parent working fell by 20.7 per cent (231 000) and the number with two parents working rose by 51.1 per cent (387 000). The largest group of families in 1979 had one person working; in 1995 it was two persons. The proportion with no parent working rose from 11.2 to 16.9 per cent, the proportion with one parent working fell from 52.9 to 36.6 per cent, and the proportion with both parents working rose from 35.7 to 46.7 per cent (p. 225).

Table 4: The clustering of employment in two-adult families, Australia, 1979–95

Family type, by number of parents working	1979	1995	Percentage change
	Thousands	Thousands	%
No parent working	238	415	73.5
One parent working	1118	887	- 20.7
Two parents working	756	1143	51.1
All families	2114	2445	15.7

Social inequalities

Work by Gregory and Hunter draws attention to the polarisation of regions. Over the 1976–91 period, employment was heavily skewed towards areas of high socio-economic status. In the bottom three deciles the employment-to-population ratio fell 20 per cent—it fell 28 per cent in the bottom decile. In the top three deciles it was effectively unchanged, increasing marginally in the top decile (Gregory & Hunter, cited in Dunlop & Sheehan 1998, p. 226).

For education and training, social inequalities pose a difficult set of problems. Education and training provide the main avenue for employment opportunities, and to the extent that they provide a common framework of opportunity, offer potential compensation for prior inequalities. Yet in a common framework of opportunity, those with prior advantages tend to come out on top.

Gender segmentation

Gender segmentation at work is associated with another set of persistent inequalities. In an otherwise orthodox economic study of the returns to educated labour, Preston (1997, pp. 72–3) finds that there is a 'raw' gender gap of 19.9 per cent between male and female earnings. She states that 27 per cent of this can be explained by measured differences between men and women, such as periods of child-rearing. The 'adjusted' gender gap is therefore 14.5 per cent. Women earn only 85.5 per cent of the wages of their male counterparts. During the 1980s the gender gap *widened* by 8 per cent. Preston concludes that the weakness of human capital theory is its inability to explain significant and persistent inter-industry, inter-occupational and gender-based wage differences.

Anker (1997) points out that orthodox economics cannot satisfactorily explain gender segmentation. Human capital theory implies that women have much lower human capital than men, yet the gender gap in higher education has partly closed. Economics casts little light on the reasons why child-rearing is so organised that it is predominantly women's work and associated with the weakening of earning and promotion prospects; why women's abilities are less well valued; why certain occupations remain substantially female; why these women's occupations remain lower paid; why men are more likely to have flexible work and women more likely to have work that is contingent.

Benschop and Doorewaard (1998) make similar points. This suggests that feminist theory might be useful in explaining these issues. Whereas orthodox economic theory treats all human agents as equivalent and interchangeable, feminist theory starts from the premise of gender domination and inequality. It transforms the analysis of economic distribution with an explanation of relations of power that are prior to economics.

In the Australian trades, gender segmentation is spectacularly discriminatory. Here the work system and the training system have tended to reinforce each other. In their study of apprenticeship, Dockery and Norris (1996) examine the ten largest trade groups, accounting for nearly half trades employment. In five groups there are virtually no women: metal fitters and machinists, structural/boilermakers/welding; electrical mechanics, plumbers, and vehicle mechanics. Women are a large majority in hairdressing and the garment trade. In both industries, the average rates of return on investment in the apprenticeship are negative, as it is for the predominately male vehicle mechanics and gardeners At a discount rate of 5 per cent, hairdressers have lifetime earnings that are $54 600 (7 per cent) below those of unqualified workers.

Education, training and economic growth

In economics, 'new growth' or 'endogenous growth' theories have given renewed impetus to investigation of the rich but complex relationships between education and training on one hand, and industrial activity and economic outcomes on the other. In contrast with standard neo-classical growth theory, endogenous growth theory (see for example Dowrick in Economic Planning Advisory Council 1994) treats technological change as internal and normal to modern economies. It models a relationship between, on one hand, expenditures on R&D, education and training, and on the other, the take-up of technological change, and rates of economic growth.

The role of education and training is crucial at two stages: in the early processes of innovation or adaptation of innovation, and in the gradual and the larger the number of firms in an industry that are involved, the more rapid will be the overall rate of technological change, feeding into competitive advantage (Auerbach 1988, pp. 12–13). Here the rate of diffusion is conditioned by both the quality and spread of general education and training, and by the targeted provision of the specific skills and knowledges required.

Education, training and technological change

Basu and Weil (1996) emphasise that technological innovation and technology transfer are specific to the particular combination of inputs, including educational inputs. Miller and Mulvey (1997) note that computer usage is associated with a wage premium of 13 per cent for males and 16 per cent for females. They cite similar findings by Kreuger in relation to the United States. Krueger estimated that the growth of computer use accounted for up to half the increase in the rate of return to education in the second half of the 1980s.

Bartel and Sicherman (1995) focus on the impact of technological change on the skill acquisition of young American workers. They note that technological change can act as a complement to the stock of human capital, by increasing its productivity. It can also increase the economic value of time spent in training, relative to work. The presence of technological change may weaken the relationship between education and training, if the process of learning new skills becomes simpler, which increased the value of time spent in investment in training to a greater extent for educated workers. The same outcome occurs if technological change increases the substitutivity of education and training in the production of human capital; that is, the general skills of the more educated enable them to adapt faster to the new technology, enabling those general skills to stand in lieu of the acquisition of specific skills and thereby dampening the otherwise positive effect of education on training.

Bartel and Sicherman find that when controlling for a set of worker, job and industry characteristics, workers in industries with higher rates of technological change are more likely to receive formal company training than those working in industries with lower rates of technological change. They also find that in general, more-educated workers are more likely to receive company training, although there are some exceptions; for example, non-production workers with 13–15 years education train more at higher rates of technological change, while those with more than 16 years train less at higher rates of technological change. They suggest that 'the rate at which an individual's stock of general knowledge and problem-solving skills depreciates as a result of technological change is likely to be less than the rate for specific, vocational skills' (p. 7).

Those with general education need to 'top up' their vocationally specific skills from time to time, but general education itself has a longer half-life and needs 'topping up' less often. At the same time, those with general education also have an underlying advantage in the

capacity to acquire general skills—although whether this is due to the human capital they have acquired, or other factors such as social status, is not clear. Nevertheless, these data highlight the importance of general education in underpinning a high-skill economy based on continuous job improvement and training, and hence the role of public authorities in underpinning general education.

At the same time, Bartel and Sicherman find that while more-educated workers are more likely to receive formal company training, on average, the training gap between the highly educated and the less educated *narrows* as the rate of technological change increases. This is true for both production and non-production workers. Perhaps the new information technologies in themselves facilitate training for the less educated, or otherwise 'level' the educational base, so that deficiencies in prior general education are less of a handicap, or perhaps they simply require a more universal training culture. Technological change is also associated with more training overall. This takes the form of an increase in the incidence of training, not in the number of hours per training spell.

Levels of education and incidence of occupational training

Lynch and Black (1995) agree that there is a 'virtuous circle' between education and occupational training. Employees with more advanced schooling are more likely to be augmented by employer investments in training. Here employer-provided training complements rather than substitutes for formal education. They also confirm that the hiring of better-educated workers is associated with higher productivity. They suggest formal training outside working hours has a positive effect on productivity in manufacturing, while computer training raises productivity in non-manufacturing firms.

Howell and Wolff (1992) note the studies demonstrating that educated workers are more able to adapt to new job tasks and changes in work organisation that accompany technological change (see for example Bartel & Lichtenberg 1987). However, this work has been conducted at the aggregate level rather than controlling for industry-specific characteristics, and mostly treats skill requirements in the workplace as equivalent to educational attainment. This ignores specific workplace requirements for cognitive, interactive and motor skills. Howell and Wolff find that both cognitive and interactive skills are closely correlated to educational attainment, but the relationship between *changes* in educational attainment and changes in skill levels is weaker. They also find that, while skill growth is closely correlated to technical change, there is little correlation with productivity growth. This might be explained by 'the costly adjustments that often accompany fundamental changes in production' (Howell & Wolff 1992, p. 141).

The economics of education

Correlations between education, training, wages, and—less certainly—productivity are easy to find. The more fundamental question is whether these relations represent relations of cause and effect—whether particular investments in education and training can be expected to generate particular macro or micro-economic outcomes.

The majority of economists support the propositions of human capital theory which argue that investment in education leads *directly* to improvements in earnings, productivity and aggregate economic growth (see for example Quiggin 1994). Other economists argue that these alleged effects only hold under specific circumstances. Still others argue that education and training are *necessary but not sufficient* conditions for improved productivity and economic growth—that other, complementary settings are also necessary if education is to have beneficial effects, such as appropriate work organisation, technologies and management strategies. A further group argues that the economic role of education is principally to screen potential employees on the basis of personal characteristics signifying potential productivity (Blaug 1985).

Here economists' positions tend to reflect prior theoretical judgements. Attempts to resolve these issues have focussed on aggregate calculations, but the nature of the macro-relationships cannot really be settled empirically. At best, one can deduce that there is a strong apparent association between successful economies, and high quantity investment in good quality education and training. On the other hand, particular studies in particular industries might have more to tell us about the economic role of education and training and about how to configure education, training and production so as to maximise the synergies. (The debate is further discussed in Marginson 1993 and Marginson 1997b, pp. 92–130). Those particular studies would need to use observational data to compare the character of the skills and knowledges utilised at work with those acquired in education and training, assess the transfer of skills and knowledge and consider the conditions under which such transfers, and the potential to acquire new skills and knowledges in the workplace, are optimised; and tackle the question of the effects of one worker's acquired productivity on the productivities (joint and several) of other workers in the same organisation. In such studies, to rely on earnings figures as a proxy for acquired productivity would be a mistake: patterns of earnings reflect not only potential productivity but many other factors.

Engelbrecht (1997) argues that human capital both creates productivity directly, and is the vehicle for the diffusion of international technologies in the home country. Barron et al. (1997, p. 513) note that existing measures tend to underestimate the quantity of on-the-job training, and that previous studies may have underestimated the contribution of training to wages and productivity growth by 'nearly a factor of three'. Howell and Wolff (1992) suggest that sometimes educational attainment signifies the possession of human capital, and sometimes it simply indicates possession of the capacity to learn on the job, and other desirable personal characteristics. In other words, both human capital theories of education and screening theories of education can apply, depending on the circumstances.

The 'credentials creep'

All economies have experienced a continuing growth in the number of credentials at a given level, relative to the number of jobs, the phenomenon sometimes described as 'credentials creep'. In Australia between 1981 and 1994, for example, the number of new higher education graduates rose from 66 246 to 138 954, a doubling of graduate numbers in only 14 years (ABS 4224.0, 1996, p. 220). Between 1971 and 1991 in Australia, the total workforce grew by 35.6 per cent while the number of degree holders multiplied by 5.61 times (ABS 2710.0).

Beaudry and Green (1997) deduce from a study of the earnings of different age cohorts in the Canadian workforce that the returns associated with education have fallen. Mason (1996) finds that in some industries British graduates are being used in jobs that previously were carried out by non-graduates. Borland's (1996) study of the returns to education in Australia finds that the income-earning advantages associated with education increased slightly during the 1980s. These findings are compatible, provided that the average incomes of both educated and uneducated workers have fallen relative to all workers' earnings. This assumption is plausible.

The number of people holding educational qualifications has expanded greatly, competitiveness in the labour markets has increased, and the group leaving school early is now much smaller than before, becoming a disadvantaged minority. All of this means that, while on average the income and status returns associated with a constant level of education have fallen, the incentive to invest in education is as great as ever. Indeed, given higher unemployment this incentive is probably greater than before. Karmel's (1996) study of the demand for secondary schooling points to the influence of declining full-time job opportunities, and the growth of unemployment, which have reduced the opportunity cost of staying on at school. Another factor is the declining demand for people without educational qualifications, although the effects of this on the demand for schooling are less certain.

Government investment in higher education

Studies of the education 'production function' by Hanushek (for example 1996) conclude that the relationship between increased investment in education and improved educational outcomes is weak or non-existent. Hanushek's work has been used by governments throughout the world to support reductions in public spending on education, and/or reductions in the role of government in the provision of education (Institute of Public Affairs 1990; Quiggin 1994).

In Australia, the proportion of the GDP allocated to public expenditure on education declined from 5.9 per cent in 1975–76 and 5.6 per cent in 1983 to 5.3 per cent in 1992–93 and 4.9 per cent in 1995–96. The most striking change has been in the priority accorded to outlays on higher education in Australia. In 1975–76, when the higher education system enrolled about 280 000 students, public spending on higher education constituted 1.53 per cent of the GDP. In 1995–96, with more than 600 000 students in higher education, the level of public spending had fallen to only 1.18 per cent of the GDP. Between 1975–76 and 1992–93, government final consumption expenditure in higher education declined by one-third relative to student load (ABS 5510.0; Marginson 1997a, p. 220).

It appears that scepticism about the potential of educational expenditures is greater in Australia than in many comparable countries. The OECD estimates that in 1994, direct public expenditure on educational institutions was 4.6 per cent in Australia, below the OECD country mean of 5.1 per cent and at a lesser level than 16 other OECD countries, including Canada (6 per cent) and New Zealand (5.6 per cent). Norway had the highest level at 6.8 per cent (OECD 1997).

Nevertheless, Hanushek's work is less than definitive of the complex relationship between resource inputs and educational outcomes. His definition of educational outcomes—largely confined to scores in standardised competency tests—is narrow; and his analytical methods and policy conclusions are vigorously disputed by Hedges et al. (1994) and Goldhalber and Brewer (1997).

Others have no doubt about the efficacy of public investments in education. Pelloni (1997) models education as a public good rather than a market good. Taking the Malaysian economy and education system as the illustration, Poh (1996) finds that improved human resources, underpinned by education and training, are the key elements in the high growth rates that until recently were a feature of the South-East Asian economies. While some private sector involvement is necessary, the government is always the principal key to investment in education.

> *This role cannot be left entirely to the private sector because the long-term objectives of human resource development to match the demand and supply of labour involves longer-term planning and large financial resources which only the government is capable of mobilising. Firms will be more interested in short-term gains...* (Poh 1996, pp. 180–1).

Tegart et al. (1998a, p. 362) are concerned about the potential negative effects of falling public funding in higher education, relative to enrolments. The trend has encouraged the universities to pursue private incomes, and this can have positive effects in promoting industry–education linkages, but there is a danger that institutions are being diverted from their public good functions from which all of industry benefits: the functions of providing a high-quality education for Australian students and to 'contributing to the knowledge base so vital for economic and social development'. Sen (1997) takes another tack, calling for a broader understanding of human capability than that of inputs to productivity. Teese calls for recognition of :

> *... the full range of cognitive, cultural and social benefits which flow from schooling. These include generic skills, orientations to learning, attitudes to intellectual work, to technical and artistic accomplishment, moral and aesthetic values, and personal security and well-being.*
>
> (Teese 1994, p. 63)

He states that without assessing outcomes in terms of 'higher order skills and values', no meaningful conclusions can be drawn about how we use resources, and about the distribution of learning differences between individuals.

Studies of training

While there are more studies of the economics of education than the economics of industry training, especially on-the-job training, research on training is increasing. Among this research is the work of Bartel and Sicherman (1995) who find that all else being equal, more-educated workers are more likely to receive company training (p. 24). Barron et al. (1997) discover that 'establishments report 25 per cent more hours of training than do workers', although the two groups report a similar incidence of training. This is partly because of genuine difficulties in measuring the distinction between work and on-the-job training. Acemoglu and Pischke (1998, pp. 6-7) make a similar point. Many firms pay at least part of the costs of general training. Workers mostly do not pay for training by taking a wage reduction. One reason is the 'contracting difficulties' between firm and worker which derive from the difficulty of distinguishing training time from work time—a difficulty compounded by some firms who use trainees in regular production activities. Ideally jobs should be skill-reflexive, in that the worker continually thinks about the skills and knowledge that he or he needs to acquire to perform effectively. In that sense there can never be a perfect measured separation between training and work, certainly not in the workplace.

Formal training in USA companies

Lynch and Black (1995) provide data on 'formal training' in USA organisations with more than 20 employees. This includes all structured training whether on or off the job, but excludes 'unstructured training' which includes learning by observing others, and informal, one-to-one instruction from supervisors or co-workers. Altogether 81 per cent of establishments provided some kind of formal training, with 57 per cent reporting an increase in training since 1990 and 41 per cent no change. Large establishments are much more likely to provide structured training: 99 per cent of those with more than 1000 employees, but only 75 per cent of those with 20–49 employees.

The incidence of training is relatively low in the textile and apparel industry, construction, transport services, and wholesale and retail trade; and high in the chemical, petroleum and primary metals sectors in manufacturing and communications, utilities, finance and insurance. Over 80 per cent of establishments in utilities, finance, insurance, chemicals and petroleum products offer computer skills training, but only 30 per cent in retail. Over 75 per cent of establishments in utilities, finance, insurance, chemicals and petroleum products pay for or provide teamwork training. More than two-thirds of formal training is during working hours.

Sources of training vary, with 50 per cent of establishments using equipment suppliers or buyers and 36 per cent private consultants, compared to 34 per cent using industry associations. Technical and vocational institutions (33 per cent), community and junior colleges (30 per cent) and four-year colleges or universities (20 per cent) were less important. Informal training on the job is sometimes a substitute for, sometimes a complement to, formal training. In their study of American engineering plants, Mason and Finegold (1997, p. 94) report a high level of informal training, often over several years, 'with machinists being pushed to continue learning new machines and products to the limit of their ability'. A third of the American plants also provide comprehensive adult training programs in basic and technical skills. A minority of supervisors have college qualifications while the majority have no formal qualifications at all.

Continuous training in Germany

Pischke (1996) describes 'continuous training' in German industry between 1986 and 1989. 'Continuous training' includes both formal and informal varieties although, as he notes, the latter is difficult to measure. Training is predominantly a white-collar phenomenon and concentrated among the more highly educated, the services sector, and public administration. 'Basically no continuous training is received by those with few initial skills', so that training tends to exacerbate pre-existing inequalities in the distribution of skills (p. 9).

There is more training in large rather than small firms, among younger people, and among men rather than women. More than two-thirds of those participating in training did so in more than one course during the time period. The employer carried at least part of the cost in 80 per cent of the cases of the training of those already in employment, although the majority of the participation in training was initiated by workers alone. A large part of the skills received in training in Germany are portable to other employers. This underlines the point about the willingness of employers to fund general training. Of those employees in training, the largest number (71 per cent) stated that they wanted to be able to adapt to changes in their industry, occupation or workplace. Other important reasons were the need for additional qualifications for promotion purposes, refreshing old skills and learning new ones. Almost half of the blue-collar workers mentioned learning a new occupation.

Training in Australia

Burke (undated) summarises training in Australia. Data from the Australian Bureau of Statistics (ABS) show that in the July–September period in 1993 employers spent $1109 million on formal training, constituting 2.9 per cent of gross wages (2 per cent internal training, 0.9 per cent external training). This was equivalent to about 1 per cent of GDP. One-quarter of all employers reported making such expenditure, including 100 per cent of employers with 100 employees or more, and only 18 per cent of those with 1–19 employees. The average formal training per employee was 5.6 hours. In addition, 82 per cent of employees received on-the-job informal training (pp. 16, 26–7).

A further ABS survey for July–September 1996 found that employers spent $1179 million on structured training. Compared to 1993 there was a slight rise in total expenditure, but expenditure as a proportion of gross wages declined from 2.9 to 2.5 per cent; and both expenditure per employee, and hours of structured training, had also declined since 1993. The proportion of employers involved had dropped sharply, from 22.6 to 17.8 per cent. Among small businesses the fall in employers providing training was marked. A low 13 per cent of employers with 1–19 employees provided structured training. Expenditure in manufacturing declined, although expenditure in personal and other services, and education, increased. The level of spending in the construction industry was very low. The ABS suggested that the suspension of the training guarantee in 1994, and its abolition in 1996, contributed to these trends (ABS 1997, Cat no 6353.0).

A further ABS survey for the 12 months ending in February 1997 found that 61 per cent of employers provided some training. More of them provided unstructured training (53 per cent) than structured training (35 per cent) with 27 per cent offering both forms of training. Almost all organisations with more than 100 employees provided training, compared to 57 per cent of those with 1–19 people. The proportion of employers providing training was much higher in the public than the private sector, especially in relation to structured training. Industries with the lowest training proportion were transport and storage, construction, and cultural and recreational services. The training incidence was highest in government administration, personal and other services, and education (ABS 1998, Cat no 6356.0).

The survey of a small group of leading managers cited by Tegart et al. (1998b, p. 25) notes that 43 per cent prefer to acquire new skills by recruiting new labour, or contracting-out, rather than training existing staff. Among the remaining employers, the largest number favoured on-the-job training (22 per cent), followed by formal in-house training, above external training.

However, in manufacturing, the employers prefer formal in-house training to any other method.

Apprenticeship training in Australia

Dockery and Norris (1996) investigate the costs and benefits of apprenticeship training in Australia. Based on lifelong earnings, the overall rate of return on apprenticeships is 46 per cent for men but is negative for women, who are concentrated in the low-paying hairdressing and garment industries (see above). Dockery et al. (1997) note that although apprentices are in decline as a proportion of the total labour force, they now constitute 30 per cent of teenagers employed full time. In the first year, the cost of supervising apprentices is nearly equal to their wages, and their production value is low. After that, production increases more quickly than wages and supervision costs fall. By the fourth and final year, 93 per cent of all employers consider apprenticeship to be a net benefit.

The finding that so many firms bear a large cost in providing apprenticeships is at odds with Becker's (1975) postulate that individual trainees should bear the costs of general education, rather than the firm. Why do profit-maximising firms behave in this manner? 'Employers seem to be influenced by a wider faith in the benefits of investing in training and in supporting the apprenticeship system to avoid skill shortages' (Dockery et al. 1997, p. 270). Acemoglu and Pischke (1998) make the same point. Firms pay for some general skill acquisition. This is partly because workers with general skills are better able to learn the specific skills whose benefits are captured by the employer; partly because some skills are industry rather than firm specific and thus are both specific and general at the same time.

VET and the diffusion of capacity

The contemporary trends to networked relationships and to international marketing, exchange and collaboration and the accelerating rate of technological change, coupled with the universalisation of computing and communications technologies, have significant implications for VET institutions and for on-the-job and formal training in workplaces themselves.

The general objective is to obtain competitive advantage by improving the capacity of organisations and workers in initiating, diffusing and responding to changes in technologies, work organisation and work process. For example, if training achieves over time a *reduction in the time taken to learn* new processes or technologies; for example, in a strategically positioned industry such as telecommunications, the long-term economic payoff could be very significant. This in turn would depend on the development of greater facility and flexibility on the part of both managers and the labour force. To contribute to this, VET institutions would need to be close to the organisational and technological cutting edge in the industry concerned. They would also need to become stronger in preparing student trainees for participatory and team-based production, for those approaches are associated both with higher productivity and faster diffusion. Given the existing culture of Australian industry, it is vital to encourage management support for autonomous teams that are capable of more initiative than is currently the norm.

All comprehensive VET institutions will need to become increasingly knowledgeable about regional countries, their education systems and their economic profiles, and develop a greater facility in regional languages. All preparatory courses will draw on computer skills, and the teaching of those skills to established workers will need to increase:

> *While new entrants into the labour market are more and more likely to have computer skills, new ways will have to be found to help incumbent workers acquire these skills either through their employers or off-site at their local community colleges or training institutes* (Black & Lynch 1997, pp. 21–2).

Here 'computer skills' will include the capacity to work with the systems and networks that are increasingly central to all jobs. Technological change is also driving the need for a higher level of cognitive and interactive skills, which will need to be factored into curriculum design. The changes to work within VET itself should be equally great. All ongoing personnel will need to be networked, and regular users of the Internet for the purposes of administration, teaching and information retrieval. Most personnel will also need to become capable in Web-related functions such as home page design.

VET institutions and innovations

However, the key strategic task is not so much the one-off generalisation of new technological capacity, as to install in Australian industries an *ongoing capacity in relation to innovation*. To repeat the earlier argument, most innovative firms do not remain innovators for very long. There is immense potential advantage to be gained by those organisations able to overcome their own inertia sufficiently so as to become ongoing innovators. If VET institutions themselves cross this threshold, they will become much more effective—although given the need for high quality equipment and infrastructure and skills, it is not easy for VET institutions to achieve this. Their capacity to do so will depend on selective government assistance.

Geroski et al. (1997, pp. 45–6) note that while all practical knowledge loses salience over time, 'knowledge relevant to an innovative field tends to have sharply diminishing returns'. The first corollary of continuous technological and organisational change at work is a preparedness to engage in continuous change in training and education. The second and most important corollary is the construction of an ongoing reflective learning culture within industry itself, resourced by VET. The third corollary is to support a broad and various range of approaches, creating an environment in which innovations can flourish. The fourth corollary is to create efficient structures for innovation, so that change in one part of the operation does not demand the transformation of every other part.

As part of a capacity in continuous innovation, jobs themselves need to become skill reflective. That is, workers need to be able to think critically about their own skills and knowledges, comparing their personal profile to the requirements that their jobs make of them, and identify the areas in which their skills and knowledges need to be improved. As noted, this is premised on a greater degree of trust and autonomy (although not a lesser degree of performance pressure) than currently applies. It is also premised on a certain level of general education—including the capacity to reconstruct critically the work environment—and personal confidence. Further, because of the economic externalities involved, skill-reflective capacity would be better exercised in a team environment than on a solely individual basis. The skills and knowledge possessed by each individual affect the others in the work group, the more so when new technologies are involved.

On-the-job training

Drawing his data from interviews with skilled workers, Billett (1993) mounts a powerful case that greater attention should be given to on-the-job training. Workers in his study named this as the form of training that had most shaped their capacities. Billett argues that learning practices need to be pertinent to the activities, culture and social relations in the relevant vocational setting. Stating that knowledge is developed in the context of its use, he emphasises a 'socio-cultural' understanding of work and training, 'authentic' learning experiences, and engaging learners in 'a culture of practice'.

One virtue of workplace learning is the scope for expert guidance, skilled mentors who introduce trainee workers to the factors determining occupational judgements. In contrast, pre-employment modes of learning provide 'substitute experiences' developing 'conceptual, procedural and dispositional knowledge' not readily transferred to practice.

Billett notes that not all workplace settings lend themselves to on-the-job training. This training requires a structured learning environment, access to other learners and expert guidance. Some of Billett's interviewees also doubted whether work-based learning provides the necessary conceptual architecture. The implications for VET are a continuing role in both general education and training, and in the resourcing of on-the-job training. The optimum training program combines the two elements, as apprenticeships. Billett (1993, p. 1) urges greater 'access to authentic learning experiences' in formal institutions. The emphasis on vocational specifics, even in the off-the-job VET institutions, contrasts with assumptions that the main output of off-the-job institutions is generic skills in isolation from specific vocational contexts. The notion of context-free generic skills is highly problematic (Hyland & Johnson 1998; see also Norris 1991; Marginson 1993, pp. 143–71).

The 'dual' system of Germany, Austria and Switzerland

Training in Germany, Austria and Switzerland has been successfully built around a dual approach in which three years training in technical schools is combined with private work arranged by the apprentice's employer. The curriculum is strong enough for some students to advance to higher level engineering courses. Training is multi-skilled and prepares workers for jobs that are highly integrated in character (see above).

> *Compared to other industrialised countries, the availability of multiple or polyvalent skills permits a high degree of functional and task integration in production. Workers are able to perform flexibly a large variety of tasks and to fulfil a multitude of planning and service functions. The technical offices for design, process and production planning and control can rely on a broad pool of practical and theoretical skills. This range of competences and the cultural proximity of workshop and offices enable feedback structures and mechanisms of organisational learning to develop, processes can be fairly accurately planned in advance, interfaces are more precisely defined and as a consequence the deviations between formal and informal organisation are smaller than in other countries* (Kohler & Woodard 1997, pp. 68–9).

More than 50 per cent of young people are involved in the dual system in the Germanic countries. The model enjoys almost universal support in the literature. However, it is important to recognise that this highly successful model is specific to the German context. It cannot be successfully transplanted into other national settings unless its enabling conditions are present. One of those conditions is the relatively high status accorded to both vocationally specific training, and skilled blue-collar work. Whether a general academic preparation, a dual track (academic/vocational) preparation, or a half-way house between the two, is more appropriate for Australian secondary education is too large a question to consider in this study. It requires an extended investigation in its own right.

This argument for placing a greater priority on on-the-job training suggests also that training programs for the unemployed should also focus primarily on an on-the-job component, with the important proviso that such work experience must be authentic; that is, they must be 'real' jobs. However, the question of training in relation to unemployment has received substantial discussion elsewhere and will not be pursued in this study.

The role of public policy

One virtue of the German system that is difficult to replicate in Australia is that employers bear the greater proportion of the total costs of training. This raises the question of the respective roles of government and employer in an environment of perpetual innovation. Government has a special role in providing the framework of policy and practice in which training provision is aligned with industrial innovation. This government responsibility for inter-institutional co-ordination is irreducible. No other body can play the role, and that role is indispensable. Long lead times and the presence of public good factors mean that no market organisation can play the part of government in co-ordination:

The central fact about the modern process of innovation is that it is based on a division of labour, as Adam Smith clearly foresaw when he wrote about the role of philosophers and men of speculation. Division of labour produces efficiency gains from specialisation and professionalisation but it also requires a framework to connect together the component contributions of different agents. As far as knowledge and skills are concerned this aspect of connectivity, or technology transfer, cannot be effectively co-ordinated by conventional markets... the connectivity of technology-producing institutions should be a central concern of technology policy (Metcalfe 1995, p. 34).

Antonelli and Marchionatti (1998, p. 17) suggest that a policy designed to support technological innovation should include targeted investment in the new technologies in traditional firms; the speeding of networking between, on one hand, the weaker branches of an industry and, on the other, the information/communications industries; the establishment of communications standards; and 'a training policy able to supply the markets with high levels of skilled manpower that speeds up the adoption within small and medium-sized firms, especially in backward regions and traditional industries'. Gallagher and Sweet (1997) conclude their discussion of skill development in British Columbia by calling for a common policy framework across the public and private training sector.

Government policy, intervention and innovation

Dockery et al. (1997) make the point that the lower the skill content and the shorter the learning time, the quicker employers can begin to profit from training. This implies that employers have a weak incentive to invest in training for complex and sophisticated technologies; and that the greater is the technical transformation required, the more important is the role of government in financing (and perhaps in providing) training. Thus the role of government can be crucial role in determining whether innovations take place, and the speed of their diffusion.

Once a new technology is established, in production and training, this imperative role of government begins to recede. The notion that the role of government (rather than market) peaks at the point of innovation may seem counter-intuitive. However, this does not mean that market competition is absent. It is markets that drive the imperative to remain at the forefront of technological change. Rather, it means that if Australian companies—with their small size and capital base, and their pronounced industry variation in levels of training and levels of innovation—are to be players in many of the emerging markets, they will need to be supported by targeted public policies.

In technological innovation, in relation to in-house training and global networking, the larger firms enjoy the economic advantages. Indeed, in most industries, if small firms are to become serious players, government intervention is crucial. Policies of assistance to small firms are particularly vital in the Australian context because the national dependence on small firms as drivers of industry innovation is greater than in most other countries. Here government should not substitute for the role of the firm in innovation and training, but should strengthen it. For example, instead of focussing exclusively on off-the-job training, government can support the development of targeted on-the-job training programs that are closely integrated with the technologies in use. This involves making policy judgements about the expected course of economic development, and raises the inevitable question about whether governments should be involved in 'picking winners'. The answer is that they are and should be involved in such judgements, but in conjunction with industry rather than separated from it.

While governments might lack the private sector capacity in the calculation of fine degrees of risk, they add a vital long-term planning horizon, and also enjoy a larger financial capacity than do most private companies. Their capacity to support genuinely new developments is thereby advanced. A further question is that of the desired mechanisms for industry–government consultation. However, that lies outside the framework of this paper, which stops short of defining appropriate policy mechanisms.

The notion of government supporting 'specific' training might appear to clash with Becker's (1975) assumption that specific training benefits the firm and is its responsibility. Nevertheless, the real world does not always follow Becker's notion of the division of labour. For example, firms themselves provide much of the support for general training such as apprenticeships, although Becker would have it that general training is the province of trainee and government. The simple fact is that unless government shares some of the cost of training located within the firm, the level of training in Australia in areas subject to rapid technological change will fall decisively short of long-term economic requirements. Policy should be based on outcomes, not on abstract formulae.

Training and immigration

What should be the respective roles of training and immigration in the fulfillment of skill requirements? The full investigation lies outside the framework of this study, but some relevant data have been noted. As noted, the rate of technological change and diffusion is accelerated by workers with advanced interactive skills, skills which are highly dependent on cultural context. This points to the value of training personnel already familiar with the cultural context, as opposed to bringing in people with a lesser level of familiarity. However, the potential economic arguments concerning immigration take in more elements than just its role as a potential supplier of labour to meet immediate skill requirements.

Education and training policy to address inequities

Finally, government has a particular role in the provision of a general framework of educational opportunity, and in compensation for the growing inequalities generated by markets and technological competition. For example, we know that the market logic is such that the people most likely to receive industry training are those who have already received advanced levels of education. One of the tasks of government is to compensate for this by the provision of training opportunities targeted to particular social groups. It is difficult to sustain a universal approach to education and training when opportunities for work are distributed in binary fashion. This is an old problem: throughout the world, the state provision of a common framework of opportunity is over-determined by the vertical differentiation of educational institutions, outcomes and individual participation, intersecting as it does with the prior inequalities between different social groups.

This long-standing systemic tendency to reproductive social ranking in education is exacerbated in a period of increased economic and social inequalities, coinciding with the growing role of private costs and market forces (with their inevitable vertical effects) in education itself (Marginson 1997b). This merely underlines the importance of the state's role as social corrective. If government fails to introduce an element of greater equality into the distribution of opportunities, there is no other social or economic institution that can assume the role. At the same time, in an environment where particular inequalities are if anything greater than before, especially in association with regional factors and with unemployment, there may be an increased need to support those who are notably disadvantaged. This suggests that the optimum role of government encompasses two elements: a common framework based on a universal entitlement to training, coupled with targeted support in particular circumstances.

Most importantly, government needs to draw the growing elements of 'contingent' labour into the policy mainstream. We know little about the levels of training of people who are home-workers, or working with temping agencies, or contracting a series of temporary jobs. Precisely because of the growing reliance on contingent labour, there are more than equity issues involved here. The overall capacity of the future workforce is at stake, especially given that some of the fastest-growing industries in communications and business services are also among those with a higher than average reliance on contingent labour.

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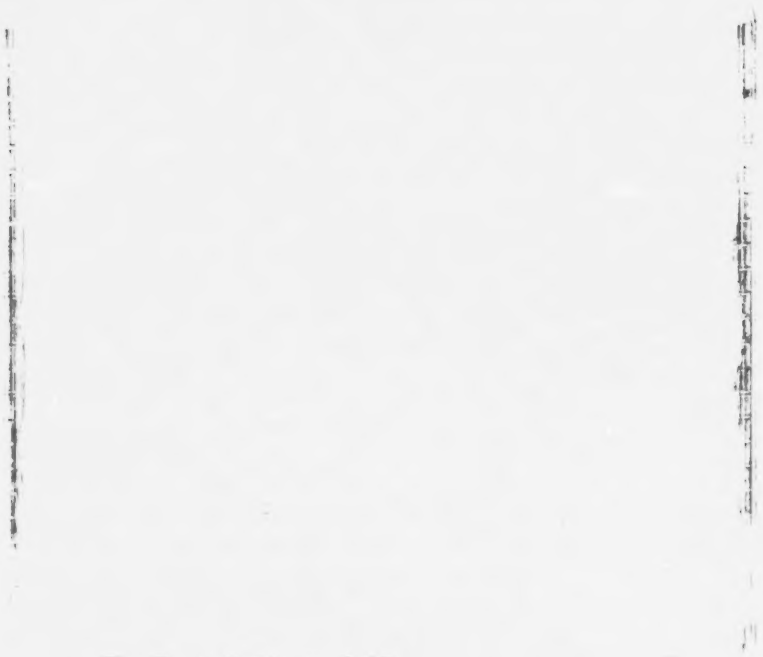

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'General purpose education both facilitates the acquisition of more specific skills and provides workers with the flexibility necessary to realise their comparative advantage' (p. 25). However, on-the-job training may be at least as important as formal schooling in determining productivity. 'New technologies and organisation require continuous learning, best accomplished by workplace training' (p. 1).

Becker argued that workers had the incentive to invest in general training up to the market-required level, providing capital was available, eg. by taking a wage lower than their productivity, while firms had sufficient incentive to invest in specific training (p. 2). Where training is general, wages after training grow at the same rate as productivity (p. 15). Hence Becker questioned the need for government regulation of and subsidies for training. However, the general/specific skills dichotomy has problems. Skills may be industry-specific and thus general as well as specific (p. 2). Firm-specific skills often influence how productive general skills are. 'The knowledge of how to use a particular software is much more valuable when an employee knows the exact goals of his division'. General skills and specific skills are complements and are positively correlated, eg. a rise in general skills produced a rise in specific skills too (p. 11). Also, in practice there are many cases of firms paying for at least part of the costs of general training. One reason is that firms are looking for a firm-specific mix of general skills (p. 11). When looking at why firms pay for training, credit problems faced by workers can only be at most a partial explanation. 'Labor market imperfections, that is deviations from the perfectly competitive market assumed by Becker, must be part of the story' (p. 2).

In Germany apprenticeship training is industry financed but it is largely general in character. There is a prescribed curriculum with an examination taken outside the specific industry (pp. 3-4). US firms running temporary help agencies offer general training in office and computing skills at no cost to their hirees (p. 4). Studies suggest that workers in training programs mostly do not pay for the costs by taking lower wages (p. 4). One reason is the 'contracting difficulties' between firm and worker which derive from the difficulty of distinguishing training time from work time – a difficulty compounded by some firms who use trainees in regular production activities (pp. 6-7). Note that this difficulty of monitoring training may mean that subsidies are relatively ineffective (p. 14). In Becker's theory the degree of wage compression has no impact on firm-sponsored training because firms do not pay for training in any case (p.16). However, models based on non-competitive labour markets, plus the empirical evidence, suggest that a compressed structure of wages encourages firms to pay for some, perhaps all, training cost: the more compressed, the higher the proportion the firm will pay (pp. 13, 16). This is because labour markets are non-competitive to the degree that wages are less than workers' productivity and must increase less steeply when workers become more skilled (p. 13) [ie. the fact that employee and employer do not meet in the labour market on equal terms is sufficient to violate the assumption of perfect markets].

Anker, Richard (1997), 'Theories of occupational segregation by sex: an overview', *International Labour Review*, 136 (3), pp. 315-339.

Occupational segregation by sex is extensive and pervasive, 'one of the most important and enduring aspects of labour markets around the world' (p. 315). It is a major source of rigidity, inefficiency and inequity. Human capital theory explains the disadvantageous position of women in terms of lower levels of human capital relative to men. Labour market segmentation theories point to an important aspect of the workings of labour markets. However, neither body of theory explains why occupations are segregated by sex and in such a manner that women's earning and promotion prospects are weakened. Economists tend to leave aside gender segregation in the choice of school subjects, why housework and child-rearing are almost solely centred on women, why the abilities of women are less well valued, why certain occupations are persistently female in character, why gender segregation in the labour market persists despite the recent increases in women's participation in both education and the labour markets. Feminist and gender theories do address many of these issues, however (p. 323). Anker goes on to discuss gender stereotyping of employment and of particular occupations, the ambiguities of 'flexible' part-time work, gender pay differentials, and other aspects.

Antonelli, Cristiano and Marchionatti, Roberto (1998), 'Technological and organisational change in a process of industrial rejuvenation: the case of the Italian cotton textile industry', *Cambridge Journal of Economics*, 22, pp. 1-18.

Facing new constraints, entrepreneurs must confront those constraints innovatively. It is not enough to make the right decisions taking those constraints as given. Industrial modernisation is about adjustment in the face of constraints. 'When the changes required are radical and non-homogenous to the historical pattern of behaviour of potential adopters, cumulative obstacles to change arise. The search for an efficient organisation fails and the firms lose innovative energy (p. 15). This suggests grounds for intervention. The authors examine the interaction between technological and organisational change in the Italian cotton industry. The industry was a world leader in technological innovation in the 1970s and early 1980s but lost ground in the 1990s. They discuss factors that have retarded the diffusion of new information technologies, drawing out implications for industry policy, with some references to training.

The typical structure of Italian firms in the textile industry was functional in terms of the demands of 1970s and early 1980s. In this period the industry's productivity grew remarkably and outstripped the rest of Europe. There were two decades of interlocking technical innovations, coupled with both a reduction in the number of firms and a shift in favour of smaller scale firms. Smaller firms were better able to bear the costs of new technology promoting a tendency to specialise in either spinning, weaving or finishing. 'The representative firm became the small, specialised, modern firm, used to operating successfully in a highly competitive international environment by exploiting its

flexibility and its ability to innovate readily', and led by strong entrepreneurs able to move quickly to create competitive advantage, 'permitting a rapid and full exploitation of the technological innovations which accompanied the success of the Italian cotton industry in world markets' (p. 8). Here the interaction between machine suppliers and cotton producers was important.

In the second half of the 1980s the Italian industry became less competitive. After 1987 total production declined and the pace of technical change slowed overall. This period was characterised by the introduction of new information technologies (NITs) which when associated with new organisational structures, new skills and new intermediate inputs, provided very considerable scope for productivity improvements across the production/realisation chain. Antonelli and Marchionatti note in a footnote that:

> *Firms that have been able to adopt information technologies, as a process innovation, and to implement them organisationally, have clear advantages in terms of: (a) increased access to multisourcing; (b) global scope of procurement; (c) reduction of stocks of inputs; (d) reduction of paper-work; (e) better control of quality standards; (f) reduction of litigation and negotiating costs; (g) reduction of minimum efficient size of production lots; (h) footloose location of plant; (i) enhanced customisation of production; (l) increased use of sub-contracting relations; (m) increased scope for cooperation among different firms; (n) increased coordination between R&D, production and marketing; (o) reduction in delivery lags; (p) reduction of stocks of final products; (q) reduction of invoicing lags; (r) increased product differentiation; (s) increased control of market niches; (t) enhanced innovation capacity based on user-producer relations; (u) reduced price-elasticity for their products; (v) increased mark-ups* (p. 11). [There is no (j)]

However, these depended on a high level of complementarity between changes in the different parts of the technical and organisational systems, and their interface:

> *When a complex new technological system emerges, a cumulative process of growth is likely to take place along with the introduction of new complementary innovations, in products, processes and organisations, so that their effect on overall productivity levels becomes apparent only with significant delays. Complementarity requirements between innovations are key factors for assessing the overall levels of productivity generated by the adoption of each technological innovation. Only when the appropriate mix of complementary innovations is available can the full effects in terms of productivity growth be achieved. Information technologies have generally very high requirements in terms of interrelatedness and complementarity and are consequently likely to display their effects fully only when the full set of complementary and interrelated organisational and production changes have been made* (p. 11).

The introduction of NITs must be paralleled by the achievement of closer interaction between production, marketing, finance and strategic decision-making, and higher levels of vertical integration and product diversification. Data collected by the

authors indicate that in the Italian cotton industry the NITs radically modified the sequence of the various production phases, the length of the productive process, and the volume and time relationship between stocks and goods sold, modifying 'the composition of economies of scale at batch, department and plant levels'. Market relations were strengthened by electronic communications, 'and bureaucratic coordination could be replaced by a mix of cooperative relationships implemented by on-line communication systems' (pp. 12-13). For these firms the adoption of NITs enable international networking of headquarters, plants, marketing and where relevant, sub-contractors. The Italian cotton industry has now split between on one hand six large multinationals, with mobile plants, high vertical integration and product diversification - highly successful in their early adoption of NITs - and many small and specialised firms located mostly in Northern Italy and slow to adopt NIT-based techniques. There is some sub-contracting from large to small companies, facilitated by NITs. 'Our hypothesis is that the effective adoption of complex technologies such as NIT requires an organisational structure different from the existing one: firms need to be larger, more vertically integrated, and run by professional managers'. Only 'large managerial organisations' can bear the costs of 'the complex organisational changes necessary' to exploit the NITs' huge scope for productivity improvements, and wear the prolonged delays before the benefits appear (p. 11). Firm size is not the only factor. The diffusion of the new technologies is also 'strongly influenced by the learning opportunities which make it possible to acquire specific skills and consequently to elaborate new procedures and new organisations both among and within firms' (p. 12).

'An industrial policy aimed at favouring the diffusion of all the components of the new emerging technological system might generate significant effects both directly upon the recipients of such a policy that are potential late-adopters, mainly small and medium-sized firms, and indirectly upon the whole system because of the externality effects spilling over to other firms via the increased levels of networking between complementary and interrelated activities based upon the same technological system' (pp. 16-17). An industry policy aimed at enhancing the diffusion of the components of the emerging information and communications technology system could incorporate: the evaporation of super-profits derived from information/communications functions, targeted NIT investment in traditional firms, the speeding of networking between weaker branches of industry, and the information/communications industries; communications standards, and 'a training policy able to supply the markets with high levels of skilled manpower that speeds up the adoption within small and medium-sized firms, especially in backward regions and traditional industries' (p. 17).

Archibugi, Daniele and Michie, Jonathon (1995), 'Technology and innovation: an introduction', *Cambridge Journal of Economics*, 19, pp. 1-4.

The article introduces a special issue of the journal on the economics of technological change. [Several articles from that special issue are included in this bibliography.] They make the point that nation-specific factors are important in promoting technological change:

> *Technology is not easily transferable across countries but, on the contrary, is country-specific and rooted in skills, capabilities and knowledge which in turn are accumulated through time. Nations differ not only in the quantity of innovations introduced, but also in the methods by which these innovations are adopted and in their sectoral composition* (p. 3).

Auerbach, Paul (1988) *Competition: the economics of industrial change*, Basil Blackwell, Oxford.

[This is an important study, with significant insights - absent from other studies - concerning the workings of competition and the relations between technological change, competition, industry organisation and government regulation. Accordingly it is summarised at more than the usual length.]

The author's approach 'puts central emphasis on changes through time in the consciousness and facility of economic actors and how these changes change the very environment in which economic actors function' (p. 2). Normative issues are excluded 'in order to refrain from the common tendency to treat them as an afterthought and to avoid entanglements and confusions with the issues at hand' (p. 4). The author focuses on understanding and explanation of concrete historical changes. 'The domain of applicability of economic theory has become methodologically unconstrained, both with regard to historical time and to social context' (p. 3). If theory cannot act 'as an engine of prediction' it might at least point in the right direction 'and offer us at least *ex post* a mechanism for understanding what has taken place around us' (p. 2).

The widespread perspective from the perspective of mainstream economics is that 'a long-term downward trend in competitiveness has taken place'. This is based on the tendency of business concentration to increase within national economies. But 'from a dynamic, historical perspective' what has happened is that competition has been universalising and this can be understood as an upward trend in competitiveness:

> *Capitalists have progressively become more 'capitalistic' - businessmen and women ever more business like, knowledgeable and technically proficient, more flexible in their actions, more rapid and efficacious in response to profitable opportunities and less narrow and localised in their concerns. These changes in behaviour (themselves engendered by environmental evolution) have caused the functional sphere of competitive activity (the relevant 'markets') to expand over time. Furthermore, these skills and habits of mind, once considered so rare and mysterious have become and are becoming more widespread and available, both within national economies and worldwide* (p. 4).

Orthodox theory assumes the effects of social factors on individual preferences are constant over time. 'A central focus in this book is on historical evolution, where the mutual interaction of the "preferences" and "endowments" of individuals with societal factors is the essence of the process, so that the presumption of such a simple relationship is blatantly inappropriate' (p. 10). The neo-classical view is a static view of competition. 'The form of the behavioural response is passive, mechanistic and utterly

predictable'. It is assumed that market structure determines business behaviour in a one way relationship (p. 15), yet as one economic historian notes in relation to the US paper industry at the turn of the century 'it was the firms' predisposition to restrict output and support prices that had made collusion so successful in the past, not the reverse' (p. 16).

The literature on entry did not begin to emerge until the mid-1950s. However, there is now greater emphasis on the sufficiency of free entry, not just concentration. The orthodox approach seems to rely on a mix of models of perfect competition and monopoly, so that the use of 'small group' oligopoly theory and 'large group monopolistic competition' has fallen away (p. 19). There is also a key problem for orthodoxy in the definition and boundaries of markets - 'in the absence of a coherent method for delineating markets, little remains of the orthodox approach to competition' (p. 22). The orthodox approach assumes producers know what is the lowest cost at which the commodity can be produced, but this can only be discovered through the process of competition itself (pp. 22-23). Hayek noted that information was imperfect (p. 24). Further:

> *It is impossible to specify an exogenous 'market' which exists as a 'structural' constraint upon competitive activity, since it is the very nature of entrepreneurial activity to break down and make irrelevant any such encumbrances, to create new 'markets' and stretch old ones as part of their creative activity and process of discovery* (p. 24).

'In the context of orthodox theory, market delineation must be specified independently of the behaviour of participants in that market. Because of the necessary interaction between structure and behaviour in the generation of market boundaries such a task is in fact impossible' (pp. 31-32). Markets are shaped by and change with the participants so that market structure cannot be read as determining conduct (p. 33). 'The behaviour of participants in a market can never be determined exclusively by a set of market parameters which are exogenous to this behaviour' (p. 46). In practical empirical work, case study research invariably takes into account the behaviour of participants in drawing industry boundaries as if these boundaries are not to be totally arbitrary (pp. 32). Determining 'the functional sphere of competitive activity' requires that structure and behaviour are both taken into account (p. 49). Markets cannot be unambiguously demarcated from each other nor are there criteria for delineation always consistent between markets and over time (p. 33). 'A definitive solution to the problem of market delineation is not to be found, because a market is not a "thing", but a behavioural relation' (p. 51).

Historical comparisons of market concentration over time incur 'the contradictions encountered in trying to fit technological comparisons and the creation of new products - the very stuff of competitiveness - into a rigid corset of pre-determined categories' (p. 42). Technological conditions are not given but can be transformed by entrepreneurial discovery in the act of competing (p. 57). The concepts of 'market' and 'industry' are so problematic that it is better to relegate them to a more secondary role in the analysis (p. 61). 'The firm rather than the industry is the unit around which the competitive process should be conceptualised' (p. 71). *The firm* should be treated as the 'moving force'. It is that which can be delineated from other entities. The firm (as the behavioural subject

that is also the object of analysis) can be used to measure competitiveness: 'The greater the speed, freedom and efficacy with which firms pursue projects in different spheres, the more competitive the economy' (p. 57). The firm does not simply act as passive respondents to the 'outside' environment but 'to a great extent, it creates its own "environment" - the number of spheres in which it chooses to operate, etc.: from this perspective, a significant constraint upon a firm is imposed by the limits of its own management' (pp. 57 & 59). The concept of a firm's 'sphere of activity' allows 'competitive entry' to be defined (p. 59) and allows diversification to be defined (p. 60). Time series studies indicate 'no decisive tendency in the direction of invisible hand equalisation' of returns under the influence of competition (p. 82). However, competition has increased notwithstanding the trend to concentration:

> *The almost inexorable tendency for the technical facility of management to increase over time, both in terms of the level of relevant skills and the number of individuals so trained implies a secular tendency for the rate of competitiveness to increase in the capitalist market economy. Such a hypothesis is incapable of meaningful formulation in the context of mainstream economics, which is largely concerned with the adaptation of individuals to a given, exogenously specified environment, one not shaped by the behaviour of its participants* (p. 109).

> *The inexorable increase in the quantity of business information, the improvement in the quality and comparability of business data with the development of the accounting profession and the adoption of standards of reporting and the general improvement in communication of all kinds - all these factors, coupled with the progressive professionalisation of management have generated a long-term tendency for competitiveness to increase in the capitalist market economy. These factors in the context of mainstream Marshallian analysis might be thought to inhibit the development of competitive practices. In a given (market) environment, factors such as the growing uniformity of accounting standards and an expansion of publicly available information might be thought to make tacit coordination less difficult between firms, and there are undoubtedly specific historical situations (especially where activity in the overall economy or in a particular sphere is stagnant) when such an analysis is relevant. We believe, however, that events in the long term must be evaluated* not *in the context of a given environment, but by how this environment is shaped and affected by the factors mentioned above, most especially the* behaviour *of the participants in that environment* (p. 112).

The development of the conglomerate and of greater mobility of capital between different fields of activity are 'striking evidence of the development of managerial technique and of the extension of its sphere of vision': this can be read as an extension and intensification of competitive behaviours (pp. 112-113). 'In a similar way, the emergence of the multinational is a powerful indication of the evolution of management skills and of the expansion in their perception of the relevant domain of their activity'. This requires increased organisational competence, expansion of information available on a world-wide scale, 'and even some sociological evolution of at least part of the managerial class in a less parochial direction'. These factors 'are central to the

expansion of the geographical domain of economic activity and of competition onto a world-wide scale' (pp. 113-114).

> *The evolution of management activity has been extending the domain of competition by breaking down barriers between 'markets' and by expanding their geographical extent. It has also resulted in an acceleration of the* speed *of the equalisation process, with a growth in the information available about profitable opportunities and the growing rapidity and flexibility of managerial response to such possibilities. These changes may not in any way be identified solely with the largest companies: the small companies may be just as 'modern' in its business techniques as the large company, as these techniques have become commonplace. Thus, the development of the information 'industry' and of sophisticated management techniques have permitted the creation of large, viable decentralised organisations, but also work in favour of increased competitive activity from small firms... This spreading and universalisation of modern business practices and attitudes, coupled with other, related developments such as the continuous spread in the availability of information and the speed and quality of transport point to a secular tendency for competitiveness to increase in market capitalist society* (p. 114).

The period 1920s to the present is marked by the spread of the multi-unit enterprise to all sectors of the economy (p. 128). Using Chandler's historical analysis, company structure follows strategy; the technology which facilitated integrated production led to a company strategy whose centre-piece was the general office. This was combined with a de-centralised structure to create the modern corporation (pp. 130-131). There are costs in using a highly centralised structure as enterprises grow in size and diversity. These costs are (1) attempts to achieve unnecessary coordination which generate overhead costs; (2) 'forced interdependencies give rise to congestion and other spillover costs'; (3)'opportunistic sub-goal pursuit is more difficult to detect and control'. Operating costs rise out of the failure to recognise 'essential decomposability', ie. situations in which sub-units could best operate autonomously. Also the failure to separate operating from strategic decision-making. But the change requires a central office (1) with a strategic sense of direction; (2) able to evaluate the merits of investment proposals originated by the operating divisions; (3) with the capacity to audit and assess operating division performance. Divisions become quasi-firms and the corporation operates in quasi-market fashion rather than bureaucratically. Sub-goals clarify *in terms of* enterprise objectives (p. 132). Self-interest seeking at the operating level becomes harnessed productively. Note that developments in cost-accounting were crucial in that they provided the basis for calculating the costs of intra-firm transfers, and the profitability/rate of return of the separate divisions (p. 133). Arguably, the widespread use of these structures also reflects their efficacy as a control mechanism (p. 134).

With the passage of time these techniques of organisation have spread beyond a small group of large firms, and have become universal; 'the sociology of value maximisation ... is all pervasive' (pp. 135-136). 'The M-form structure, far from being an unambiguous advance, is a very clever and successful compromise between total

decentralisation and complete centralisation. In situations where integration facilitates change and development, there is an obvious cost to any form of decentralisation. This does not make it a bad, or unworkable structure, but indicates that its utility must be judged in the context of substantive situations, and not merely on the a priori characteristics of the model' (p. 136).

> *Improvements in managerial technique set up countervailing techniques simultaneously. On the one hand, they make administrative coordination more attractive. Contrarily, by expanding the potential number of individual participants and their capacity to compete, these improvements may increase the role of market forces, a development which can restrict the growth of the large form either by offering direct competition or by encouraging vertical disintegration. The resolution of these 'real' factors, however, is mediated through the capital market, whose own structure and behaviour evolves over time* (p. 141).

> *Just as the wider dispersal of managerial skills pulls the M-form from below in the direction of the market, so the expansion of top management's perception of its domain of control pulls from above in the direction of planning: the present ideals of good management, such as IBM and the larger Japanese firms are based on their 'holistic', integrated concept of their activities* (p. 144).

There has been a transformation in ways of doing business in finance, a greater aggressiveness, with the old division of labour breaking down and new entities offering the full spectrum of activities (p. 191). 'New competition has also emerged from non-financial corporations such as General Electric, which has expanded far beyond its traditional role in extending consumer and commercial credit to become a significant source of funds for industry' (pp. 192-193). There is also the emergence of 'financial supermarkets' such as American Express. In addition, there is 'the progressive commodification of financial services', with marketable securities substituted for bank loans, unbundling of relationships between firms and finance institutions with firms only paying for what they want. Further, finance has been internationalised and attempts by nation states to regulate their financial markets have been progressively collapsing (p. 191). The key to the increased competition in finance has been pressure from the industrial sector, with large companies forcing the 'unbundling' of financial services (p. 194). The changes are due to both exogenous and endogenous factors, eg. changing of normal financial institutions' behaviour.

> *Technological change can be taken as a suitably 'exogenous' force upon financial institutions, and if we forget the aforementioned fact that some of the new found competition for financial institutions is coming from the* creators *of new technology such as IBM, the 'new ways of doing business' brought about by technological change – techniques of cash management, of funds transfer and a vast assortment of financial services hitherto impossible – may be taken as illustrations of 'exogenous change in the constrained optimisation of the firm that stimulates the search for new policy tools'. The new technology has also facilitated the process of commodification, permitting the creation of an enormous array of small*

denomination debt instruments and the very existence of these new telephone-electronic markets themselves. Commodification is then due to 'the exogenous shift which has taken place ... in the hardware and software that is available to run markets in financial instruments'.

These changes are not due to the domination by finance capital over industrial capital, but are 'the outcome of a progressively more competitive environment'. 'The present relationships evolving between banks and firms, far from signalling a growing dominance of financial institutions, represent a precisely contrary development. They result from the efforts of financial institutions to accommodate themselves to a far more insecure environment, one made insecure by the activities of financial institutions in competition with each other and by the ever more stringent demands made upon them by their clients, especially their business customers ... both holders and users of funds now have a wide variety of alternative sources which formerly did not exist' (p. 198). It is not clear whether the increased competitiveness of the capital market will favour large or small firms (p. 201).

The continued expansion of the depth and richness of the services provided by the market – advertising and marketing, financial management, etc. – has also dictated that specialised skills which once could only be embodied in the largest firms and were part of their 'economies of scale' are now available to far smaller entities. The growing marketisation of services in business may not only militate against vertical integration, but may act as a force promoting competition and de-concentration: much of the defence of IBM in its anti-trust case was concerned with the enormous number of Lilliputians capable of providing and servicing parts of IBM's full line of business (p. 225).

The multinational's emergence has led to a faster diffusion of managerial and technical skills and of infrastructural business institutions, throughout the international business environment. 'As a result, we observe a more rapid increase in world competitiveness' (p. 239). Nevertheless, the multinational can restrict diffusion, too: 'the creation of internal structures and the avoidance of markets permits the multinational to appropriate the full value of its knowledge and research' (p. 248). 'The major controversy at present is between the choice of relatively uniform "global product" strategy and of tailoring the product to the specialised needs of the host countries', the first implying relatively centralised structures, the second relatively decentralised (p. 251). 'Current managerial thinking is demanding an even greater sophistication - products must be produced both as part of a global strategy and yet customised to each individual nation or market' (p. 252).

Markets – the domains of competitive activity – cannot be understood apart from the mentality and behaviour of participants. The secular expansion of markets and the concomitant increasing competitiveness in the capitalist market economy are not simply due to the 'exogenous' influences of reduced costs of transport and technological progress. On the contrary, changes in technology, transport and all other factors which create the competitive environment, including the techniques of

business calculation, must be seen as part of a societal whole in which 'objective' factors interact with the evolving consciousness of participants (p. 258).

A correct perception of commercial life requires a knowledge of the totality of the society, 'from the most mundane aspects of its material conditions to its cultural formation and intellectual activity' (p. 258). In the industrial revolution in Britain, skills and attitudes, an entrepreneurial class, financial infrastructure, the scientific revolution, all facilitated technological innovation (pp. 258-259). In the twentieth century history of the trend in competitiveness, a key role has been played by technology and technological change (p. 263). Technology may influence the conditions of competition in a number of ways: (1) improvements in transport extend the domain of 'the market'; (2) all kinds of information are progressively more rapidly, cheaply and widely dispersed, enabling decisions to be informed by information relevant not only to own but competitors' behaviours and performances; (3) standardisation of products and product specifications allows different products to become commensurate and become part of a single 'market' (p. 264), in the US and Germany trade associations vigorously pursued standardisation though orthodox literature notes only their monopolistic character (pp. 274-275); (4) technological change can affect the size distribution of firms, or create more intense competition in sub-sectors of large firms; (5) the facilitation of coordination, control and information retrieval within the firm (p. 264), 'improvements in internal monitoring brought about by technical change may be as significant in engendering competitiveness as those which advance monitoring outside of the firm' (p. 265); (6) 'Change in technology may facilitate alterations in the forms that competition may take: it has been suggested, for instance, that current developments encourage a "flexible specialisation" as opposed to the tendency in much of the twentieth century towards uniform mass production of commodities; (7) 'Lastly, and most importantly: technological innovation itself is a form of competition, both within industries and across industrial boundaries: indeed, it is a commonplace of the literature of industrial innovation that crucial competitive breakthroughs derive almost invariably from "outsiders" to the industry' (p. 265).

If it is assumed that technological change is a part of the competitive process, it becomes more difficult to conceive that rapid technological change is associated with declining competitiveness. Change and refinement is continuous and this is inherent in the technological process. Diffusion of techniques is more important than conception; compare this approach with the Schumpeterian emphasis on gales of creative destruction (p. 265). There is a well-established literature on learning curves with established technology - learning by doing - but 'there has been little emphasis in economics on gradual improvements in new technologies and their diffusion. Such improvements make it extremely difficult to measure the interval between "invention" and innovation, since much of it is taken up by further inventive activity which improves the product'. Adoption of the new technique is critically affected by the rate of these improvements. The opposite also holds (p. 267):

The more rapid the rate of diffusion – the larger the number of firms attempting to improve the new techniques and adapting them to their special needs – the more quickly such improvements are likely to come about. The pace of diffusion of new

techniques is, therefore, not only an important determinant of the level of an economy's competitiveness, but of technical change itself, broadly considered (p. 267).

If the incidence of technological 'shocks' changes, this can affect the trend in economy-wide competitiveness (p. 267). 'The responsiveness of the capital market in making available funds both for research and for new investment is clearly crucial [ie. to the rate of diffusion] but is, like entrepreneurial attitudes, an issue apart from intrinsic changes in the underlying potential for the diffusion of new ideas' (p. 268). The spread of technological 'know-how' in the economy is more important than exemplary 'showpiece' inventions. Science can be taught abstractly and impersonally, and 'new achievements can be written down relatively objectively in a verifiable form' (p. 269). 'The pool of individuals capable of monitoring, replicating and imitating new innovations and therefore competing with them is far larger than if we were in a world with an equal number of scientific minds, but where commercially relevant innovations possessed the same percentage of incommunicable "craft-mystery" as they did in the eighteenth century. The movement to science-based innovation has clearly been a key aspect of the acceleration of the speed of diffusion of these innovations in the twentieth century' (p. 269). 'In summary, reductions in the cost of acquiring information about new innovations have accelerated the rate of diffusion of new ideas and reduced the relative size of enterprise necessary to receive this information' (p. 269). On the other hand, the rise in development costs of new projects has favoured larger firms. 'Even more significant is the relationship between innovation and the expansion of managerial perspective. In the contemporary world, the extension of the business planning horizon among very large firms has implied that innovation must be coordinated to take into consideration a progressively broader range of supply and demand-based complementarities' (p. 270).

The effects of a rise in market concentration may have been reversed by the vast expansion of the internal markets in the US in this period, as well as the introduction of many new products and new ways of doing business (p. 274). The promotion of cooperation among firms in Japan by MITI seems to have little effect in limiting domestic competition or dampening the competitiveness of Japanese firms in international settings (p. 278). Further, in Japan very high concentration has been associated with tremendous economic dynamism (p. 285). Planning also played a major role (p. 286).

Should a statistical approach be used to identify competitiveness and competition? Phenomena such as firm turnover, speed of technical diffusion and changes in leading firms' market shares are symptoms of competitiveness but do not measure competitiveness itself, eg. a firm may maintain a stable market share only by aggressively competitive behaviour, behaviour symmetrical with that of its competitors. 'If we are interested in the underlying *dynamic* of competitiveness and not merely "evidence" in the naive sense, the search for a "plausible story" may demand greater use of qualitative, non-quantifiable variables than is possible in a statistical analysis (p. 278-279).

Rises in concentration, far from being invariably a cause of reduced competition, are often responses to an increasingly competitive environment, and sometimes these rises result in more, rather than less competition. Joint ventures and other forms of cooperation between firms may indeed signal reduced competition in specific instances, but have often appeared as competitive responses to a changing environment. certain forms of cooperation, for instance cooperation in the setting of uniform standards, can themselves be instrumental in changing the 'parameters' of the existing environment in a more competitive direction (p. 323).

Substantive cases demonstrate the nebulous nature of the dichotomy between 'planning' and 'the market'. Markets are not in fact 'things' to be used by economic actors, but relationships chosen by those actors, so that the extent and richness of a market will be contingent on the behaviour of participants in that market. Just as the market environment indubitably has its effect on the behaviour of participants, so too will the actions of participants affect the nature of the market. For any individual participant, a choice may exist between planning and 'using the market', but the nature of the planning decisions made by participants will collectively influence the environment in which these decisions are made (p. 323).

Thus at present we may be observing an accelerated development of markets, while there is movement by many firms in the direction of more sophisticated planning and integration (pp. 323-324).

The tendency to increased competitiveness in itself does not suggest either greater profitability and growth, or less, despite orthodox theory (p. 324). It depends on the particular combination of circumstances that applies. Periods of stagnation might appear more competitive because of price wars etc., but are likely to be associated with a slowing of the rate of increase in competition (p.325). All else being equal, competition is maximised during periods of high growth. Government is crucial: 'Government not only responds to the existing competitive environment with such acts as the setting of tariffs, but in a deeper sense is instrumental in the creation of that environment' (p. 325).

Increasing competitiveness, along with macroeconomic fluctuation are the most important factors defining the politics of our day (p. 326).

The effects of increasing competitiveness include: (1) swifter punishment of laggards in the world economy; (2) more pressure to technological change displacing workers or at least displacing some old skills; (3) more pressure on workers through capacity for greater monitoring and surveillance at work; (4) business looking further afield for labour; (4) 'the growing irrelevance of national boundaries as traditionally conceived for an analysis of the competitive environment' (p. 326-327).

Avis, James (1993), 'Post-Fordism, curriculum modernisers and radical practice: the case of vocational education and training in England', *The Vocational Aspect of Education*, 45 (1), pp. 3-14.

The paper critiques the post-Fordist reading of vocational reform. It argues that the potential for a paradigm break in the direction of a high skills/high trust/flexible economy-society – characterised for example by small batch production, niche markets, flatter organisational structures, competition by innovation and sub-contracting, multi-skilled workers and regular on-the-job training, greater pluralism and choice, etc. (p. 7) – is more limited than often claimed. Work and training are still implicated in a capitalist framework. Much of what is said to be post-Fordist is more Fordist (p. 3).

Barron, John M., Berger, Mark and Black, Dan (1997), 'How well do we measure training?', *Journal of Labor Economics*, 15 (3), pp. 507-529.

The authors compare six measures of on-the-job training, and draw on one new source which compares the responses of employers and employees to identical questions. All sources agree that there is a great deal of informal training for newly hired workers. For all workers, the incidence of off-site training is higher for workers with more tenure (p. 513). Barron et al. suggest that previous studies may have under-estimated the effects of training on wage and productivity growth by 'nearly a factor of three'.

The new study finds that 'establishments report 25 per cent more hours of training than do workers, although workers and establishments report similar incidence rates of training' (pp. 507-508). The incidence of informal training exceeds 70 per cent (p. 526). Establishments estimate a mean of 10.7 hours of formal training and 82.7 hours informal training in the first month of employment. Workers estimate a mean of 8.3 hours formal training and 69.3 hours informal training (p. 522). The correlations between worker and establishment measures are less than 0.5, though higher for aggregate training than for any individual training measures (pp. 507-508). [This points to the boundary problem of distinguishing on-the-job training from work, and suggests that employers might have a vested interest in requiring both simultaneously.] The correlations between worker and establishment estimates are almost the same for both formal and informal training. 'Our analysis suggests that there is a great deal of error in measures of training' (p. 526).

Bartel, Ann P. and Sicherman, Nachum (1995), 'Technological change and the skill acquisition of young workers', *National Bureau of Economic Research Working Paper* No. 5107, NBER, Massachusetts, MA.

Using the National Longitudinal Survey of Youth the study focuses on the impact of technological change on skill accumulation among young male workers in the American manufacturing sector during the time period 1987-1992. Increasing wage inequality between college and high school graduates might suggest that the status of less educated

workers deteriorates with the pace of technological change. However, it is also necessary to consider the impact of technological change on the post-schooling investments of different education groups. Technological change may act as a complement to the stock of human capital, ie. increase the productivity of human capital, reduce the cost of training (eg. through technology-aided instruction), or increase the value of time in training relative to work (p. 1 and pp. 4-5). The study uses various proxies for industry rates of technological change, including productivity growth data, data on investment in computers, R&D/sales ratios by industry, industry use of patents, and subjective data from surveys of managers (p. 3).

> *Controlling for a set of worker, job and industry characteristics, workers in industries with higher rates of technological change are more likely to receive formal company training than those working in industries with lower rates of technological change. This finding holds for all but one of the six proxies for the rate of technological change in an industry* (p. 30).

The presence of technological change may weaken the relationship between education and training, if the process of learning new skills becomes simpler, thereby increasing the value of time in investment in training relatively more for educated workers. The same outcome would occur if technological change increased the substitutivity of education and training in the production of human capital, ie. the general skills of the more educated enable them to adapt faster to the new technology, dampening the otherwise positive effect of education on training (p. 9). The study finds that for all workers, production and non-production, the more educated are more likely to receive company training (p. 24). Production workers who have completed some or all of high school train significantly more at higher rates of technological change (p. 25). Production workers in manufacturing industries with higher rates of technological change are more likely to receive formal company training, but not other types of training. Non-production workers with 13-15 years education train more at higher rates of technological change, while those with more than 16 years train less at higher rates of technological change (p. 25). While more educated workers are more likely to receive formal company training, *the training gap between the highly educated and the less educated narrows, on average, as the rate of technological change increases*. [NB. This is a very important finding.] This finding is true for both production and non-production workers (p. 24). It is consistent with the hypothesis that educated workers have an advantage in relation to new technologies, undergoing shorter adaptation times.

The positive effect of technological change on hours of training is due largely to an increase in the incidence of training, not in the number of hours per training spell (pp. 28-29).

> *Technological change therefore acts to increase the extensive margin of training, increasing the pool of trainees* (p. 30).

'The rate at which an individual's stock of general knowledge and problem-solving skills depreciates as a result of technological change is likely to be less than the rate for specific, vocational skills' (p. 7). The three industries with the highest computer share

of investment are electronic computing equipment; radio, TV and communication equipment; office and accounting machines (p. 17).

Basu, Susanto and Weil, David (1996), 'Appropriate technology and growth', *National Bureau of Economic Research Working Paper* No. 5865, NBER, Massachusetts, MA.

The authors develop a model of growth and technology transfer based on the idea that technologies are specific to particular combinations of inputs. This is seen to be more realistic than the usual specification in which 'an improvement in any technique for producing a given good improves all other techniques for producing that good'. The model implies that technology improvements diffuse only slowly even without barriers to knowledge and adoption costs. The authors claim that their model generates more realistic predictions than either the standard neo-classical model or simple endogenous-growth models. The model is used for inter-country comparisons of relative incomes and growth rates. It leaves out expenditures on R&D, assumes full international technological mobility and no time or money costs of technology transfer, and treats savings rates as exogenous and constant rather than modelling them as outcomes of optimisation (p. 20). These areas suggest potential extensions of the model.

Beaudry, Paul and Green, David (1997) 'Cohort patterns in Canadian earnings: assessing the role of skill premia in inequality trends', *National Bureau of Economic Research Working Paper* No. 6132, NBER, Massachusetts, MA.

The age-earning patterns for more recent cohorts are deteriorating in comparison with older cohorts. This is true for both university-educated and high school educated workers. Between 1981-1993 the difference between average earnings of male workers aged 45-55 years and those aged 25-35 years increased by 18 per cent (p. 1).

> *Recent male labour market entrants, regardless of their education, are earning dramatically less than their predecessors at the same age and there is little reason, based on current trends, to expect them to catch up* (p. 21).

University sample: at age 32, the 1986 cohort earned 20 per cent less than the 1964 cohort (p. 10). High school graduates: 'the evidence clearly indicates that the labour market entrants since 1978 have been performing poorly in comparison to previous cohorts' (p. 15). There is no evidence that the returns to experience have increased over time – the almost universal assumption in the literature - or that there is increased within-cohort dispersion. These findings conflict with the hypothesis that the observed increase is largely explained by an increased premium to skill. Hence 'it might be concluded that 'the increased age-differential reflects a deterioration in lifetime earnings opportunities for newer labour market entrants (p. 1). For women the observed patterns

are different - there are only minor differences between age cohorts. 'Skill premia contribute surprisingly little to an understanding of the changes in wage inequality in Canada', the notion of a deteriorating labour market for young males is more explanatory (p. 3). The study begins with the entry-level cohort of 1962 (p. 5). [But there is a problem with the empirical analysis. It is not comparing like with like over time. The entry cohort is those who turn 25 or 26 in a numbered year, but we know that the education and labour market experience of young people has changed dramatically. For example, since the 1970s there has been a great expansion of the number of graduates so that holding a degree has less clout in the labour market. Also a much greater proportion of graduates in their mid-20s now have to wait a year or more before they obtain recognisably 'career' employment, and graduates in some disciplines wait several years. In other words a lower proportion of graduates in their mid-20s are already in high-income-earning career jobs. Starting at age 30 years would eliminate at least this problem.]

Benschop, Yvonne and Doorewaard, Hans (1998), 'Six of one and half a dozen of the other: the gender subtext of Taylorism and team-based work', *Gender, Work and Organisation*, 5 (1), pp. 5-18.

The authors compare gender differentiation of workforces under two kinds of work organisation, a hierarchical Taylorist setting with a high level of functional and task differentiation, and a team-based setting in which there is greater flexibility and interaction across a range of functions and tasks, within a hierarchical framework. Benschop and Doorewaard emphasise that the test of gender relations is not the stated principles governing the workplace, but the power relations constituted in practical life. They state that workplace relations are composed by four elements: structure, culture, interaction and identity.

> *Structural arrangements refer to the design of work and the allocation of personnel. Cultural arrangements are expressed in manifest expressions, underlying values and basic assumptions. Interactional arrangements pay attention to the role orientation of men and women in the organisation, to status characteristics (specific or diffuse), to sexual and nonsexual attraction and to information patterns shaping interaction... Identity arrangements refer to self-image and the perception about of others and have to do with gender identities as well as with professional identities* (p. 6).

The Taylorist system provides more ready means for differentiation of labour along gender lines. Nevertheless, the authors find that gender inequality is reproduced in both settings, resulting from the 'gender sub-text', which culturally structures work relations. This prevents the equalising potential of team-work from being expressed. Both forms of organisation rest on an abstract conception of the ideal worker which, though neutral in form, in reality corresponds more closely to men than women. The subordination of women is secured also by the assumption that care responsibilities are women's work, and male-centred notions of qualifications (skilled and unskilled, rational and emotional

and so on) and career behaviour. These aspects suggest that men give greater priority to full-time work, and are more willing to invest the maximum amount of time and energy, and thus that men tend to be more suitable candidates for promotion. Case studies from the Dutch banking sector are used to illustrate the argument.

Billett, Stephen (1993), 'Authenticity and a culture of practice within modes of skill development', *Australian and New Zealand Journal of Vocational Education Research*, 1 (2), pp. 1-28.

Billett reports on a November 1992 to March 1993 study examining skilled workers' perceptions about the characteristics of their work, and how they acquired and developed skills. Learning practices need to be pertinent to the activities, culture and social relations in the relevant vocational setting. Knowledge is developed in the context of its use. He emphasises a 'socio-cultural' understanding of work and training, 'authentic' learning experiences, and engaging learners in 'a culture of practice'.

The author mounts a sustained and convincing case for greater attention to on-the-job learning, arguing that formal pre-employment modes of learning provide 'substitute experiences' which might develop 'conceptual, procedural and dispositional knowledge' not readily transferred to vocational practice. The on-the-job form of training was overwhelmingly dominant among workers included in the study (for example p. 9). Not all workplace settings lend themselves to this mode of learning, which requires a structured learning environment, access to other learners and expert guidance (pp. 2, 24). Though the majority of respondent workers found that workplace learning augmented higher level cognitive skills, there are also some doubts about the capacity of workplace learning to provide the necessary conceptual architecture (p. 20). This suggests the need for intervention from skilled mentors; and indeed, one virtue of workplace learning is the scope it creates for expert guidance, relating to trainees on the grounds of the cultural setting (p. 24). 'Integrated' (apprenticeship-style) approaches linking workplace learning with learning in other settings can be useful. He also urges greater 'access to authentic learning experiences within formal learning' (p. 1).

Billett, Stephen (1994), 'Searching for authenticity: a socio-cultural perspective of vocational skill development', *The Vocational Aspect of Education*, 46 (1), pp. 3-16.

This article contains a similar argument to that cited above. It emphasises the benefits of the 'socio-cultural' and workplace-grounded approaches to the development of problem-solving skills – which are highly context dependent – and more generally, in facilitating the transfer of learning. It further develops the earlier points about access to expert tuition, noting that this facilitates the capacity in 'far' transfer, the transfer of knowledge and skills into new situations rather than simply replicating them in new settings similar to the old ('near' transfer). 'Far' transfer is about professional judgement and that is facilitated by mentoring as a form of learning. 'Being able to

apply skills in novel situations distinguishes experts from novices (p. 12). If the value of workplace learning is acknowledged, it follows that it is desirable 'to provide structure to facilitate this type of learning' (p. 14).

Black, Sandra E. and Lynch, Lisa M. (1997), 'How to compete: the impact of workplace practices and information technology on productivity', *NBER Working Paper* No. 6120, National Bureau of Economic Research, Cambridge MA.

There have been many studies of the impact of capital investments and R&D on productivity but very little direct analysis of the impact of workplace practices on productivity (p. 1). Studies of the impact of computers on productivity have not been able simultaneously to control for workplace practices and human capital investments (pp. 1-2). The authors use data from a nationally representative sample of American business, the Educational Quality of the Workforce National Employers Survey, matched with the Bureau of the Census' Longitudinal Research Database, to examine the impact of workplace practices, information technology and human capital investments on productivity. The effective return rate for manufacturing firms was 66 per cent (p. 12). The authors use a standard Cobb Douglas production function with cross section data augmented by their measures of workplace practices, information technology and human capital investments (p. 2).

They find that what is associated with higher productivity is not so much whether or not an employer adopts a particular work practice but how that work practice is implemented in the workplace. For example simply adopting a total quality management (TQM) system has an insignificant or negative impact on productivity unless the proportion of workers involved in decision-making is also high (p. 3). Firms both unionised and involved in 'transformed' industrial relations practices, that promote joint decision-making plus incentive-based compensation, have higher productivity than non-union plants with these characteristics, and still higher productivity than traditional unionised plants. Productivity is also positively correlated to the average educational level of production workers and the proportion of non-managerial workers who use computers (pp. 2-3).

> *Establishment practices that encourage workers to think and interact in order to improve the production process are strongly associated with increased firm productivity* (pp. 3-4).

About 54 per cent of employees in the sample are involved in regular meetings to discuss workplace issues (p. 22). Raising the educational level of the establishment by 10 per cent, approximately one more year of school, increases productivity by about 5 per cent. But employers appear to adjust the educational quality of their workforce by changing the mix of production and non-production workers, rather than hiring more educated production workers (p. 21). Because computer skills make a difference to production work:

While new entrants into the labour market are more and more likely to have computer skills, new ways will have to be found to help incumbent workers acquire these skills either through their employers or off-site at their local community colleges or training institutes (pp. 21-22).

Modelling a base-level workplace to test the effect of variations in the production environment, if the proportion of non-managerial workers using computers rises from 10-50 per cent, productivity increases almost 5 percentage points (pp. 23-24). 'The proportion of managers who use computers is never significant in any specification we tested' (p. 20). The existence of capital stock appears to have an insignificant effect on productivity but 'the existence of a research and development centre within the firm is associated with significantly higher productivity' (p. 20). Benchmarking based on competitors' standards, and profit-sharing, are both associated with higher productivity. 'Higher employee turnover is associated with lower establishment productivity' (p. 22). New establishments have higher productivity than older ones, all else being equal. The proportion of employees who are women or minorities has no observable effects (p. 23).

Firms that made communications skills a priority in recruitment did better than average over the 1998-93 period (p. 25).

Borland, Jeff (1996), 'Education and the structure of earnings in Australia', *The Economic Record*, 72, No. 219, December, pp. 370-380.

The study uses the ABS income survey data to examine trends in the earnings of workers with different levels of educational attainment, from 1968-69 to 1989-90. Previous research suggests that earnings differentials between education groups narrowed between the late 1960s and the early 1980s, and then remained steady or widened slightly between early and late 1980s. 'The combination of large relative supply changes and stability in relative earnings between education groups in the 1980s' is of interest (p. 371).

These studies use the typical human capital approach which compares the returns to persons leaving education at or before the end of school, to those accruing to a degree or trade certificate. That is, they measure the rates of return on additional investment in education, variously understood as a qualification, or additional years of study. Borland also follows this approach: 'average annual earnings of each education group in each sample year are expressed relative to the average annual earnings of workers who did not complete high school' (p. 372). If it is to be read as the *only* measure of returns to education, there are a number of problems with this approach. First, it masks changes in the denominator, the returns to persons leaving school. As Borland notes in passing in a footnote, this is not a constant (p. 372). As the proportion leaving school shrinks, this group becomes small and in labour market terms, much weaker than its predecessors. Second, and related, this approach measures the returns to education relative to those without education, but not relative to the group as a whole. For example, where the returns to both school leaver and degree holder decline by the same proportion and the relative position between the two groups is unchanged, the calculation shows no decline in returns to investment in a degree. Another method is to measure the relative returns

to education, for example by mapping changes in the earnings of an educated person vis a vis all people in the age group. This second method allows the diminishing returns to education to be tracked. The first method measures human capital acquisition, the second measures the standing of education as a status/positional good. Both measures are relevant to social science, but only the first is used by economics. Arguably, by combining them we throw some light on the macro-sociology of education, as well as better answering Borland's question above. For example, this combination of trends helps to explain how the overall standing of education can decline but the incentive to invest in education remains constant, which are two strong and apparently contrary developments of the last two decades.]

Borland relies in the ABS data on changes to the earnings of full-time workers, noting that this creates difficulties in longitudinal comparisons, as the incidence of part-time work has risen sharply, from 27 per cent of working males over 15 years in 1968-69, to 43 per cent in 1989-90 (p. 371).

Borland's results confirm those of the other studies. Relative to the annual earnings of a person not completing high school, the earnings of a man with a degree fell from 2.352 in 1968-69 and 2.078 in 1973-74, to 1.712 in 1985-86, before rising to 1.804 in 1989-90. For women, the fall was from 2.081 in 1973-74 (earlier data are not available) to 167.9 in 1985-86 and 1.704 in 1989-90 (p. 372). He then poses the question: do changes in earnings differentials represent effects of changes in the relative price for different skills, or changes in the relative quality of workers with different levels of attainment? [It could of course be both factors. And the question of whether changes in the relative rewards to educational attainments is a proxy for changes in skill requirements is beyond the competence of this data set.] He uses synthetic cohort modelling to derive the conclusion that both factors are involved (p. 374). Using Katz-Murphy analyses he finds a clear shift in demand for workers, in favour of workers with qualifications, relative to those leaving school early. This holds for all qualification levels. 'The main source of the demand shift has been increases in the shares of employment of workers with higher levels of educational attainment, rather than changes in relative earnings of workers in each education group (pp. 377-378).

See also R. Gregory, 'Higher education expansion and economic change', *Australian Bulletin of Labour*, 21, pp. 295-322.

Burke, Gerald (undated), *Dimensions of education and training: Australia from 1988*, paper prepared for the National Board of Employment, Education and Training, Monash University–ACER Centre for the Economics of Education and Training, Monash University, Melbourne.

This is a valuable summary of data concerning the 1988-94 trends in the demographics of educational provision, enrolments in all sectors, the financing of education, training and labour market programs, and staffing levels.

Burke's data on training in industry, drawn originally from ABS, show that in the July-September period in 1993 employers spent $1109 million on formal training, constituting 2.9 per cent of gross wages (2 per cent internal training, 0.9 per cent external training). This was equivalent to about 1 per cent of GDP. One quarter of all

employers reported making such expenditure, including 100 per cent of employers with 100 employees or more, and only 18 per cent of those with 1-19 employees. Average hours of formal training per employee were 5.6. In addition, 82 per cent of employees received on-the-job informal training (pp. 16, 26-27). He also notes that in 1993-94 the Commonwealth outlayed $1155 million to labour market programs, although this amount was subsequently reduced sharply by the Howard Government (p. 27).

In 1991 the Finn committee devised targets for educational participation. It was hoped that in 2001, 95 per cent of all 19 year olds – later revised downward to 90 per cent - would have completed Year 12, or an initial post-school qualification, or be participating in formally recognised education and training. Burke estimates that in 1990, 73 per cent of 19 year olds met these requirements. By 1992 the figure had risen to 78 per cent. There was little change in 1993 and 1994 (p. 30). For 22 year olds, the Finn committee wanted 50 per cent – later revised upwards to 60 per cent – to have completed qualifications to Australian Standards framework Level 3 or be proceeding to a higher qualification. The data are murky. ABS classifications of qualifications have been revised. The actual proportion in 1994 was between 44 and 52 per cent, depending how basic vocational qualifications are interpreted (p. 31).

Carnoy, Martin, Castells, Manuel and Benner, Chris (1997), 'Labour markets and employment practices in the age of flexibility: a case study of Silicon Valley', *International Labour Review*, 136 (1), pp. 27-48.

In industrialised countries such as the USA the standard employment relationship, until recently, consisted of full-time employment for an indefinite period with a single employer, with the employer determining conditions of work. Flexible production is closely associated with the new competitive conditions in the global information economy and is marked by a '*disaggregation* of labour'. Work organisation shifts from permanent, stable collections of 'jobs' to individualised, flexible employment defined by human capital portfolios. Individual flexible workers move between workplaces on demand or are self-employed, providing labour services on demand. In Japan and the UK 40 per cent of the population is self-employed, part-time or temporary (p. 27).

Silicon Valley is a testing ground for studies of flexible production. It is a new industrial region, entirely post-war, it is a centre of innovation in production, and its products are a driver of innovations elsewhere. 'These industries are characterised by the fact that they use their own products in production and management processes before these products are diffused onto world markets. Silicon Valley is thus the laboratory of a new technological paradigm that is spreading worldwide, with all due adaptations to specific institutional environments'. Among the prominent features of the new mode of industrial organisation are flexible work, new forms of networking and mobility, and 'contingent employment' (p. 28). Silicon Valley could be expected to exemplify these forms, as its companies must place a premium on flexibility if they are to be competitive. The case study examines the different forms of flexible employment in the Valley, and maps trends in them.

The majority of non-standard jobs are low paid or marked by poor working conditions, but in Silicon Valley a significant though still small minority of such jobs

provide opportunities and enhanced conditions (albeit at the cost of increased risk). Further, 'in a market where skills quickly become obsolete, it may also lower worker risk by taking skill formation out of the hands of the employer' (p. 29).

Contingent employment entails reduced, tenuous or indirect ties between employer and employee; definitions vary, some including all part-time work and self-employment (pp. 29-30). The term's implication of asymmetrical benefits to employers does not always hold: some part-time work is voluntary; the term 'flexible' is better. It is better to define all involuntary part-time work as 'contingent'. [Are they suggesting here that 'flexible' implies neutrality between employer and employee? This would place the chosen over-arching term in question, as they have stated that the majority of flexible work favours the employer.] They go on to suggest that even if flexible work is not entirely voluntary 'it may potentially provide greater flexibility without the major social costs implied where workers are forced into highly unstable, low-paying secondary jobs, as contingent labour' (p. 31). [The confusion multiplies. See again the confused approach on p. 3 where they state that flexible *should be* about mutuality and *is* largely about asymmetry of power, but they appear to rest their ultimate meanings on the normative/should-be approach. It would be better to use 'contingent' for asymmetrical jobs and 'flexible' where there is genuine mutual flexibility.]

Forms of flexible work include:

- Individuals hired through temporary employment agencies;
- Individuals hired directly by firms on a temporary, contract or project basis;
- Part-time employees;
- Certain categories of self-employed persons;
- Individuals employed on an informal basis, such as day labourers or people doing home-based work;
- Certain categories of subcontracted labour whose conditions of work are primarily controlled not by the direct employer, ie. the subcontracted firm, but by the firm controlling the contracting (p. 32).

They then provide data on the different kinds of flexible work in the USA and in Silicon Valley. Employment via temporary help agencies has grown dramatically, now constituting 1 per cent of American employment and more than 3 per cent in Santa Clara County, the zone under study here. Part-time work has risen to 17.5 per cent of all American employment and 16.3 per cent in California (both 1993 figures). Self-employment in the USA was 7.7 per cent of total civilian employment in 1993 and over 7 per cent in Silicon Valley in 1995. Trends in informal day labouring, home-based work and sub-contracting are difficult to measure. In Santa Clara County there has been a huge rise in employment in business services (doubling 1984-1995) in such areas as advertising, computer and data-processing services, consumer credit reporting, building services, security, personnel services etc., and this area is a rough proxy for sub-contracted work (pp. 34-37). The authors estimate that roughly 219,600-325,660 persons in Silicon Valley are engaged in some form of flexible employment and that flexible employment accounted for about 27-40 per cent of all employment in 1995. Flexible employment is growing between two and a half and four times as fast as overall employment. 'At the least, more than half the growth in employment in Santa

Clara County in the past ten years can be accounted for by the rise in flexible employment' (pp. 37-38). It is in temporary employment – pre-eminently flexible in form – that the distinct character of Silicon Valley reveals itself. In the Valley temporary workers are most strongly represented in clerical and administrative positions (42 per cent) and blue-collar positions (22 per cent). These data are fairly close to those for the USA, but in Silicon Valley there is an unusually high concentration of temporary help service workers in technical fields (p. 40).

Carnoy et al. go on to provide quotations from managers, explaining their deployment of flexible labour. The region is characterised not only by high usage of temporary workers but by high turnover rates and inter-firm mobility among high-tech firms' most skilled employees, working a network of firms by taking accumulated skills from one to the next [and generalising industrial know-how across the industry]. The ability to find new jobs is increasingly important: hence the growing emphasis on networking, and connections. 'Employability security', which replaces single-employer employment security, rests on these qualities. This is a non-contingent form of flexibility which makes Silicon Valley an exciting place for high-tech professionals (pp. 47-48) [and inordinately shapes cultural constructions of flexible work. Post-Fordism is the ideology of the high-tech professional. For most people, its benefits are absent].

Chillemi, Ottorino and Gui, Benedetto (1997), 'Team human capital and worker mobility', *Journal of Labor Economics*, 15 (4), pp. 567-585.

'Team human capital' implies that wages are interdependent and quits must not exceed a threshold level without loss of mobility. In that respect, high mobility conflicts with productivity maximisation. These issues are explored econometrically.

Crepon, Bruno, Duguet, Emmanuel and Mairesse, Jacques (1998), 'Research, innovation, and productivity: an econometric analysis at the firm level', *NBER Working Paper* No. 6696, National Bureau of Economic Research, Cambridge MA.

Models the processes from firm investment in R&D to the introduction of innovations in production and draws on new sources of data for French manufacturing firms. The probability of engaging in R&D for a firm increases with its size as measured by number of employees, its market share and diversification, and with the demand pull and technology push indicators. Firm innovation output, as measured by patent numbers or innovative sales, rises with research effort and with demand pull and technology push indicators. Firm productivity correlates positively with higher innovation output, even when controlling for physical capital intensity and the skill composition of labour. 'It is not innovation input (R&D) but innovation output that increases productivity' (p. 2).

Dockery, A. M., Koshy, Paul, Stromback, Thorsten and Ying, Wiwi (1997), 'The cost of training apprentices in Australian firms', *Australian Bulletin of Labour*, 23 (4), pp. 255-274.

Apprentices are declining relative to the total labour force, but they provide an important source of the increasingly limited full-time employment opportunities available to school leavers. Apprentices constituted 12 per cent of full-time employed 15-19 year olds in 1966, but 30 per cent in 1994 (p. 256). The authors use a case study approach to investigate the costs of apprentices to firms, with 59 firms in the study.

Almost all employers see apprentices as a net cost in the first 1-2 years and expect to start generating returns by the end of the indenture. Wage costs increase each year, but more slowly than output. When over-award payments and on-costs are included, wage costs amount to 72 costs of the full term, and supervision costs are 19 per cent. In the first year supervision costs are nearly equal to wage costs but they decline each year after that (p. 262). In the final year 93 per cent of all employers considered apprenticeship to be a net benefit (p. 266).

Where the work has lower skill content and is learned more quickly, the employment of apprentices more quickly becomes profitable. (p. 265). [If the new technologies have a shorter learning time, and/or enable shorter learning times, the costs of training fall. But new communications systems are implicated in more complex social relations and this also has learning-time implications.]

The finding that so many firms bear a large cost in providing apprenticeships is at odds with Becker's postulate that individual trainees should bear the costs of general education, rather than the firm. Why do profit maximising firms behave in this manner? One possible explanation is that they lack perfect information. But this is not a complete explanation. 'Rather, employers seem to be influenced by a wider faith in the benefits of investing in training and in supporting the apprenticeship system to avoid skill shortages' (p. 270).

Dockery, A. M. and Norris, Keith (1996), 'The "rewards" for apprenticeship training in Australia', *Australian Bulletin of Labour*, 22 (2), pp. 109-125.

The article provides estimates of the returns to individuals on investment in apprenticeship training. The estimates are based on the 1991 Census. Estimates are made separately for different trades and there is considerable variation between them. For males aged 40, incomes for metal fitters/machinists (the highest) are about $12,000 above incomes for hairdressers (the lowest) (p. 115).

There are about 550 individual trades and the Census aggregates them into 84 occupational groups. Ten of the largest groups are examined here: together these trades account for nearly half of all trades employment (p. 111). Gender segregation is extreme, with virtually no women in five of the groups: metal fitters and machinists; structural, boilermaking and welding; electrical mechanics; plumbers; vehicle

mechanics. One gardener in ten is a woman. Women are a large majority in hairdressing and the garment trades, half the cooks and a third of the compositors (p. 113).

In the case of males, the overall internal rate of return on apprenticeships is 46 per cent, but it is negative for women (p. 123). In six of the ten trades included in the study the net present value of lifetime earnings of apprentices and tradespersons is higher than for those without post-school qualifications. The trades where this is *not* the case are vehicle mechanics, hairdressers, gardeners and garment tradespersons. At a discount rate of 5 per cent, the hairdresser has lifetime earnings $54,600 – 7 per cent – below unqualified workers (p. 118). Note that the internal rate of return is very sensitive to the level of earnings foregone during training (p. 117). In several occupations, incomes are only forgone for two years, and compositors do not forgo incomes at all.

Dunlop, Yvonne and Sheehan, Peter (1998), 'Technology, skills and the changing nature of work', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 201-252.

The paper reviews trends in the composition of employment and compares Australian data to data in relation to other Organisation for Economic Co-operation and Development (OECD) countries, especially the United States.

Employment shares by broad economic sector, Australia and the USA, 1966 and 1993

	United States		Australia	
	1966	1993	1966	1993
	%	%	%	%
Goods producing industries	37.9	24.8	45.9	28.9
Goods related service industries	22.3	24.3	26.0	25.6
Person and knowledge-based services *	21.7	34.7	24.9	40.7
Government services *	18.1	16.0	3.3	4.7
Total	100.0	100.0	100.0	100.0

* different classifications apply in the USA and Australia

It can be seen from the table (p. 206) that employment in the goods related services has been fairly stable. But the person and knowledge-based services have grown dramatically. In terms of absolute numbers, in Australia employment in goods production rose by 15,000 people from 1966-1993 while the people and knowledge services rose from 1.2 million to 3.2 million (p. 207). The structural change has actually been greater in Australia than the USA (p. 207). Of the people and knowledge-related services the fastest growth has been in property and business services (5.8 per cent p.a. between 1985-86 and 1995-96) and accommodation, cafes and restaurants (5.2 per cent) and cultural and recreational services (4.0 per cent). Communication (0.4 per cent) and finance and insurance (0.5 per cent) have grown slowly [and are presumably sharply

affected by technological change]. In manufacturing there was a 0.2 per cent p.a. decline in employment over the decade (p. 208).

There have been immense gender shifts. In 1964, 83.3 per cent of men and 32.2 per cent of women aged 15 years and over were working either full-time or part-time. In the first half of 1998 the male proportion had fallen to 66.9 per cent while the female proportion had risen to 49.5 per cent (p. 213).

As a share of the working aged population, full-time work has fallen by about 20 per cent in the 1973-1998 period (p. 213). The proportion in part-time jobs has tripled in that time. 'Full-time work remains the dominant form of labour supply in the economy': in August 1995 it constituted 88.9 per cent of all hours worked in the Australian economy (p. 215). The trend is away from full-time work however. The OECD has advanced the notion of a core/periphery model in which many companies revolve around a small full-time core and rely heavily on external resources via outsourcing, consultants and the temporary hiring of both skilled and unskilled personnel (p. 216). Possible signs of such a core/periphery model in Australia are (p. 216):

- The increasing dispersion of earnings and hours worked by age;
- The increasing dispersion of average hours worked into core and periphery groups, and the decline of the standard week;
- The increase in precarious employment;
- The growing clustering of jobs by family type (the polarisation of families into those where several people work and those where no one works);
- The increasingly neighbourhood concentration of employment opportunities.

There has been a major decline in the proportion of total hours worked by persons aged under 25 years, and persons aged 55 years and above (pp. 216-218). For males the share of hours located in the 25-54 year group rose from 66 to 75 per cent, for women it rose from 54 to 75 per cent (p. 218). There was also a sharp decline in the average full-time earnings of 15-24 year olds, relative to the earnings of 35-44 year olds (p. 219). The relative earnings of older people has also deteriorated, though less so, and more for women than for men (p. 219).

More people are working more than 45 hours a week than before, and more working less than 20 hours a week (pp. 220-222). Between 1978 and 1995 the number of employed persons working a standard (ie. 30-44 hour) week increased by only 3.5 per cent, but the number working 45-48 hours rose by 80 per cent, those working 49-59 hours rose by 142 per cent, and those working 60 hours or more rose by 206 per cent (p. 220). Those working 1-15 hours rose by 110 per cent, those working 16-20 hours rose by 110 per cent, and those working 21-29 hours rose by 56 per cent. Whereas in 1978 there were 0.75 million people working 29 hours or less, comprising 15.6 per cent of all wage and salary earners, by 1995 the number of these people had risen to 1.63 million, 24.6 per cent of the workforce. By 1995 over *half* of all wage and salary earners were working outside the 30-44 hour band and virtually all of the growth in wage and salary employment since 1978 had been outside the non-standard hours band (p. 222).

Casual employees as a percentage of all employees rose from 15.8 per cent in 1984 to 23.8 per cent in 1997. Note that it is heavily gendered throughout the period – though

decreasingly so – in 1997, 29.5 per cent of women were casual compared to 25.7 per cent in 1984, and 19.2 per cent of men compared to only 9.4 per cent in 1984 (p. 223).

Between 1979 and 1995 the number of Australian families rose by 15.7 per cent (341,000). The number with no parents working rose by 73.5 per cent (175,000), the number with one parent working fell by 20.7 per cent (231,000) and the number with two parents working rose by 51.1 per cent (387,000). The largest group in 1979 was one person working (1,118,000), but in 1995 it was two persons (1,143,000). Meanwhile the number of families with no parent working rose from 238,000 to 413,000. The proportion with no parent working rose from 11.2 to 16.9 per cent, the proportion with one parent working fell from 52.9 to 36.6 per cent, and the proportion with both parents working rose from 35.7 to 46.7 per cent (p. 225).

The clustering of employment in two-adult families, Australia, 1979 to 1995

Family type, by number of parents working	1979 thousands	1995 thousands	Percent change %
No parent working	238	415	73.5
One parent working	1118	887	- 20.7
Two parents working	756	1143	51.1
All families	2114	2445	15.7

Work by Gregory and Hunter has drawn attention to the polarisation of regions. Over the 1976-1991 period employment was heavily skewed towards areas of high socio-economic status. In the bottom three deciles the employment to population fell 20 per cent - and fell 28 per cent in the bottom decile - while in the top three deciles it was effectively unchanged, increasing marginally in the top decile (p. 226).

The authors move on to trends in the skill composition of the workforce. Changes in skill changes in the labour market can be analysed in three different ways [none of which is very satisfactory]. First, by reading trends in the occupational structure of employment, assuming implicit skill content in the occupational categories. Problem: skills are changing. Second, by proxying skill using hourly earnings. Problem: there will always be debate about the extent to which changes in relative earnings reflect changes in skill composition, changes in the rewards to skill, or other factors. Third, by drawing up a more detailed profile of occupations, grounded in skill categories. Problem: data are not always available. [This is the most fruitful approach] (p. 229).

In the 1980s, in all OECD countries white-collar work grew relative to blue-collar work and in all but two the number of blue-collar workers declined in absolute terms. There was slight growth in the USA and the Netherlands (p. 231). OECD data suggest that in all countries there was substantial growth in high-skilled workers relative to low-skilled, with high-skilled defined as legislators, senior officials, managers, technicians and associate professionals (with a slight variation in Germany). Low-skilled workers include all other occupations. In Canada, Japan, Germany, France and Italy there was low growth or an actual decline in numbers (p. 232).

A related data set compares eight countries, including Australia and New Zealand. The general pattern corroborate the trends in the six country set, if not quite as strongly. Only in the USA was there significant growth in the low-skilled cluster of occupations. For both manufacturing and services except for services in Italy, the fastest growth is in

the high-skill white-collar category (p. 233). Blue-collar high-skill is the weakest category in six out of eight countries, by a big margin, including Australia; suggesting a pronounced deskilling in blue-collar work. The exceptions are Italy where the decline in the low-skill and high-skill blue-collar categories is similar, and Germany where blue-collar low-skill work is declining while blue-collar high skill work is increasing (pp. 233-234). A further more detailed comparison between Australian data for 1987-1995 and USA data for 1985-1995 is less clear-cut. In neither country does growth in the high-skill category appear to exceed growth in the low-skill category – indeed the USA data suggest significantly higher growth in low-skill (2.4 per cent p.a.) than high-skill (2.1 per cent p.a.) employment (pp. 237-238). Australian annual rates are low-skilled 1.9 per cent, high-skilled 1.8 per cent. The difference between these data and the previous data is partly due to the growth of blue-collar low skilled in Australia, partly the growth of white-collar low-skilled work in both countries – despite the evident up-skilling of white-collar female work in Australia (pp. 238-240).

Edwards, Linda N. and Field-Hendrey, Elizabeth (1996), 'Home-based workers: data from the 1990 Census of Population', *Monthly Labor Review*, November, pp. 26-34.

The authors use the 1990 American Census data to describe and analyse home-based work. The new technologies create an opportunity for the return of market work to the home. In 1991 the Current Population Survey estimated that 18.3 per cent of non-farm workers were 'engaged in some work at home as part of their primary job'. Many of these, however, were just taking some work home, eg. in the evenings. In fact, 60 per cent of those who work at home are not explicitly paid for it. Of the other 40 per cent, about half work fewer than 8 hours per week at home, and only 15 per cent of the 40 per cent (ie. 6 per cent of all home-workers) worked 35 hours per week at home (p. 26). In addition, 1.5 million workers work entirely at home, either as wage and salary employees or as self-employed workers. More than two-thirds of all home-workers are involved in services industries, with a strong representation in personal services (four times the proportion for the economy as a whole, see p. 27). More are in farming than the average, fewer in manufacturing. Managers and professionals are over-represented among home-workers. Home-workers are much more likely to be self-employed – almost two thirds are in this category, compared to 5.5 per cent of on-site workers (p. 29). Hourly earnings are 85 per cent (men) and 75 per cent (women) of their on-site counterparts (p. 31).

Engelbrecht, Hans-Jurgen (1997), 'International R&D spillovers, human capital and productivity in OECD economies: an empirical investigation', *European Economic Review*, 41, pp. 1479-1488.

The article extends previous work on R&D spill-overs to include a general human capital variable accounting for innovation outside the R&D sector, and other aspects of

human capital (including on-the-job learning), not captured by R&D. This leads to diminished estimates of domestic R&D capital and international R&D spillovers, but these remain highly statistically significant. Engelbrecht theorises human capital as both a factor of production directly affecting productivity, and a vehicle for international knowledge transfer associated with productivity catch-up amongst OECD countries. General human capital formation, in its different formal and informal variants, appears to play a role in economic growth that is distinct from R&D.

Evangelista, Rinaldo, Perani, Giulio, Rapiti, Fabio and Archibugi, Daniele (1997), 'Nature and impact of innovation in manufacturing industry: some evidence from the Italian innovation survey', *Research Policy*, 26, pp. 521-536.

The authors use data on more than 22,000 firms participating in the second Italian Innovation Survey to analyse the number of firms involved in innovation, total expenditures on innovation (of which the most important are investment in new machinery and R&D), and the quantity and quality of innovating outputs. The picture that emerges is one in which innovation is by no means universal, and is more the exception than the rule. Small firms that innovate are in a minority in their size group, and small firms account for only a small proportion of total innovation expenditure - though those that do innovate are no less innovative than large firms. In fact, 25.9 per cent of firms with 20-49 employees are innovating firms, compared to 84.3 per cent of those with 1000 employees or more. Innovating firms constitute 33.3 per cent of all firms, 61.5 per cent of all employment, and 70.7 per cent of all sales (Table 1, p. 524). The highest proportion of innovating firms are found in aerospace, electrical and computing goods, pharmaceuticals, precision instruments, machinery and chemicals. Only 1.2 per cent of manufacturing sales consists of entirely new products. Innovation is a much larger factor in office machinery than in other industries (p. 533).

The innovation patterns in Italy are similar to those in most European countries. The data show that R&D is the most important 'intangible' innovation expenditure, though accounting for no more than one third of all innovation expenditures in Europe. In all countries the major innovation effort is in 'the adoption and diffusion of technologies embodied in capital goods. The acquisition of 'disembodied' technologies through patents and licenses is a secondary innovation component. Design expenses are also secondary. Small firms are more likely to innovate by acquiring machinery and plant, large firms by developing new technologies (p. 528).

Freeman, Chris (1994) 'The economics of technical change', *Cambridge Journal of Economics*, 18, pp. 463-514.

Freeman provides a very useful overview of research in the field up to 1994. He notes that this research is highly uneven by industry sector. In particular:

A serious weakness of this research has been the lack of attention to service industries but this is also a criticism which could be made of industrial economics more generally. Nevertheless, a few pioneering studies have been made, such as Auliana Poon's (1993) highly original research on technical change in tourism, and some work on financial services (eg. Heerje 1988, Baba 1990, Petit 1991, De Wit 1990, Cassiolato 1992, Christensen 1991). These studies, together with more general analysis of service industries (Barras 1986 & 1990, Posthuma 1986, Quinn 1986), show that most of them shared some of the characteristics of manufacturing industries of very low research-intensity (Scherer 1982b) but are now changing (p. 477).

Whereas for a long time, other industries (office machines, telecommunications etc.) determined the technical changes in services, 'with the computer revolution this may be changing'. 'In-house software development ... is now characteristic of many firms in financial services, which also have a heavier investment in ICT [information and communication technologies] equipment than most firms in manufacturing. At the same time, specialist software companies have a very dynamic role in technical change' (p. 478).

The lack of data on services is 'very unsatisfactory for many reasons, though principally, of course, for the fact that service industries now account for nearly three-quarters of total employment in some industrial countries. A second reason is that they are now deeply affected by new technologies (in particular, information technology). For example financial services are becoming very capital intensive and in particular, computer intensive; however, from the little work that has been done, it seems that they may not yet be very knowledge intensive'. 'This is a rapidly changing situation' which merits more research (p. 489).

Freeman, Chris (1995) 'The "National System of Innovation" in historical perspective', *Cambridge Journal of Economics*, 19, pp. 5-24.

Freeman argues that contrary to some of the literature on globalisation, national and regional systems of innovation remain an essential domain of both practical activity and economic analysis. He traces the mutually inter-dependent roles of national education systems, industrial relations, technical and scientific institutions, government, cultural traditions, other national institutions, using historical examples drawn from Prussia, the United States, Japan, the USSR, etc. Much of the focus has been on formal R&D institutions, especially since the changes in US science policy at the end of World War Two. R&D activity is more readily measured than are other elements. In the 1950s and 1960s the emphasis on diffusion emerged. In the 1970s and 1980s the focus on shopfloor innovation developed. The literature linked production innovation to concerns about work organisation, and relations between firms (pp. 10-11). 'Formal R&D was usually decisive in its contribution to *radical* innovations but it was no longer possible to ignore the many other contributions to, and influences upon the process of technical change at the level of firms and industries' – including external linkages within the professional science-technology system (p. 11).

Research on diffusion revealed more and more that the systemic aspects of innovation were increasingly influential in determining both the rate of diffusion and the productivity gains associated with any particular diffusion process (p. 11).

This proved important to the diffusion of each of the major new generic technologies of the 1970s and 1980s: information technology, bio-technology and new materials technology. Freeman contrasts the success of East Asian systems of innovation with the failures of South American systems. Both can be explained in terms of nationally specific aspects of the larger themes. He cites Michael Porter on the 'highly localised' character of competitive advantage. In a globalised economic framework the nation takes on a growing significance. Uncompetitive firms have less shelter, and the nation is the source of the necessary skills and technology that underpin competitive advantage. 'Differences in national economic structures, values, cultures, institutions and histories contribute profoundly to competitive success. The role of the home nation seems to be as strong or stronger than ever' (Porter 1990, cited on p. 15). When it comes to radical innovations, the importance of localised learning, together with institutional variety, is even greater (pp. 17-18).

Freeman notes that multinational corporations have an important role in the diffusion of innovations. Nevertheless, successful take-up depends on autonomous technological capability at home. This in turn rests on an interdependent relationship between technical innovations and organisational innovations. It is also important to foster both the standardised diffusion of core technologies and their conditions of being, *and* retain a capacity in technological plurality, encouraging local originality and diversity, and nourishing 'alternative sources of radically new technology and work organisation' (p. 18).

Gallagher, Paul and Sweet, Robert (1997), 'Intermediate skill development in British Columbia: policy options for a post-industrial era', *The Canadian Journal of Higher Education*, 27 (2/3), pp. 181-212.

Increasingly, it is important for British Columbia to guarantee an adequate supply of 'new economy' knowledge and skills, those usable in an economy subject to globalisation, technological change at increasing rates, the growth of knowledge-based industries, and the expansion and diversification of the services sector. Gallagher and Sweet assume that these trends will continue and that there is a major shift from low skill jobs to 'higher skill' jobs (p. 185). The article focuses on the preparation of people for 'intermediate skill' work, cognitively skilled and sometimes also manually skilled work that requires less than a university degree but more than secondary school.

Gallagher and Sweet outline education and training in the province, and recent policies, and review skill requirements. They trace the decline of apprenticeships, and the Federal Government's Canadian Job Strategy which encouraged the growth of private training, partly government-financed. 'The private training institutions came to form a second, parallel publicly subsidised system' that was distinguished only by different regulations and different funding processes (p. 189). After the collapse of

some private institutions educating international students, a Private Postsecondary Education Commission was established (1990) to register private providers. The outcome is 20 large and comprehensive public institutions, side by side with several hundred private providers with narrow curriculum specialisations (p. 190). The authors find that the roles of public and private providers have been more 'overlapping' than 'complementary'. In the late 1980s equity and access became increasingly important policy objectives. By the early 1990s the dominant approach was the deployment of training as a strategic instrument for workforce development (p. 192).

They provide detailed data on the respective roles of the public and private sectors in intermediate skills training, and conclude that a single integrated system is desirable.

Geroski, P.A., Van Reenen, J. and Walters, C.F. (1997), 'How persistently do firms innovate?', *Research Policy*, 26, pp. 33-48.

The authors use two large data bases to investigate the innovation histories of almost 5000 UK firms, that have either registered at least one US patent (1969-88), or produced at least one major innovation in the UK (1945-82). They find that their results are hard to reconcile with the widespread assumption that increases in innovation at any one time make it more likely a firm will innovate at later times. Apart from a small number of firms that each engage in a large number of innovations, most firms that complete one major innovation do not repeat the feat. This undermines the notion of innovation as self-sustaining, and the notion of continuous absorption and productive utilisation of emerging new knowledge that is acquired from the academic research literature relevant to the field in question, as a public good. It seems that very few firms have knowledge-absorbing and strategically dynamic capabilities of this kind (p. 45). It is also likely that knowledge relevant to an innovative field tends to have sharply diminishing returns (pp. 45-46).

[Their data also undermine the notion that some, successful firms become 'natural' innovators and others not. These data illustrate that innovation is a situation-determined and context-determined activity. A common pattern seems to be innovation/exploitation/habit-formation. These findings qualify the images of perpetual innovation that are part of contemporary culture, except to the extent that the small number of continuously innovating firms might represent an emerging paradigm. The point about diminishing returns to innovative technologies strengthens the normative case for continuous innovation, but in the form of paradigm shifts/changes in core product.]

Giussani, Paolo (1996), 'Empirical evidence for trends toward globalisation: the discovery of hot air', *International Journal of Political Economy*, 26 (3), pp. 15-38.

Giussani argues that globalisation is 'an ideological slogan, whose fertile ground is provided by the increase in the intensity of competition over the last twenty-five years.

This in turn is generated by a long-term decline in accumulation and growth' (p. 32). He reviews selected macro-economic evidence for claims about globalisation.

The claim that the international market predominates over national markets can be tested in three ways: the relative growth of the *world market for goods and services, the* internationalisation of capital accumulation, the analysis of international short-term speculative transactions (p. 15). The average annual growth of world exports as a proportion of world production has halved in 1970-94 compared to 1950-70 (p. 16). Trade-based internationalisation in the OECD was most rapid in the 1967-75 period. In trade, 'some countries are less internationalised today than they were before World War 1' (p. 16). There has been a rising level of trade as a proportion of product since the mid-nineteenth century, broken by the period of the two world wars and the depression. There was a major dismantling of tariffs 1945-1960, and OECD countries now face less than 5 per cent of the tariffs of 1945. However, because competitiveness has increased in general, there is a heated struggle over this amount (pp. 19-20). The doctrine that profits or extra profits only come from international trade is a revival of seventeenth century mercantilism (p. 21). Multinational Corporations have been growing in importance for longer than normally realised – their growth was especially rapid during the long boom of 1945-75 – and Multinational Corporations have a strong national bias (p. 24). There has not been a qualitative change in their role and importance. There was a sharp increase in foreign direct investment in the second half of the 1980s, but this was generated by merger activity (p. 25). It is ironic that the globalisation literature concentrates on trade and foreign investment, yet finance is the most globalised sphere (p. 31). The shift from industry to financial speculation was triggered by a combination of declining profitability in industry and traditional services, low real interest rates, and low asset prices (p. 31). There has been a general shift to short-term investment, national as well as international, leading to increased financial fragility (p. 32).

Goldhalber, Dan D. and Brewer, Dominic J. (1997), 'Why don't schools and teachers seem to matter? Assessing the impact of unobservables on educational productivity', *The Journal of Human Resources*, 32 (3), pp. 505-523.

The authors use the National Educational Longitudinal Study of 1988 data set, which links students and their achievements to a specific class and teacher, unlike most other data sets. They review earlier education production function studies. They find many to be seriously deficient in empirical methodology and available data, for example failing to control for prior achievement, and using crude aggregate measures of teacher ability such as degree levels and years of experience. Teacher motivation and skill – which are much more important determinants of student achievement – are hard to measure and are omitted from the standard regression analyses. Average pupil-teacher ratios are often used in place of class size, yet only the latter is a measure of in-class resources. These flaws in the measures can lead to dramatic variation in the measured effects of educational resources on students' achievements (pp. 506-507).

The conventional view that observable school inputs, and teachers in particular, do not positively impact [on] student achievement rests on somewhat shaky empirical grounds. The main problem is likely to be omitted variable bias arising from inadequate data and extremely crude proxies for teacher skill found in most educational production functions (pp. 507-508).

As expected, students from wealthier homes, students from homes with higher parental income, and students of more experienced teachers, tend to have higher test scores. Female teachers are associated with higher test scores (p. 512). Teachers certified in Mathematics and/or with degrees specialising in Mathematics are associated with higher test scores in Mathematics. When the subject specification is omitted, the association between degree holding and student achievement disappears (p. 520). Goldhaber and Brewer find a variety of models show that some schooling resources, in particular teacher qualifications, are significant in influencing tenth-grade Mathematics test scores (p. 505).

Hanushek, Eric A. (1996), 'Measuring investment in education', *Journal of Economic Perspectives*, 10 (4), pp. 9-30.

Hanushek has published a series of articles in the economic and educational studies literatures, using education production functions and empirical data to argue that there is no strong or systematic relationship between educational inputs (resources as measured by expenditure on schooling, teacher-pupil ratios, teacher training, teacher experience etc.) and educational outputs as measured by standardised test scores. This is a further article in that series. [The most important is probably Eric A. Hanushek, 'The economics of schooling: production and efficiency in the public schools', *Journal of Economic Literature*, 24 (3), 1986, pp. 1141-1178.] He concludes here that 'aggressive spending programs are unlikely to be good investment programs unless coupled with other fundamental reforms'. This is broader than some of the earlier literature – appearing to give resources equal weight as 'fundamental' - but he immediately qualifies that interpretation by arguing also that how money is spent is 'much more' important than how much money (pp. 9-10). He also argues that measures of educational inputs are inadequate as measures of investment in human capital, because (a) this assumes 'that inputs are converted efficiently to outputs', and (b) 'that measured school inputs comprise the bulk of all inputs into human capital' (p. 10). Human capital is also constituted by family and peer influences. 'Family influences are very important in determining student achievement' (p. 26).

US policy on schools 'in many respects' has been 'a real success story' as it led to a labour force of unrivalled skill contributing to extraordinary economic growth. However, the current picture does not reflect that long-term trend. The long-term increase in participation rates peaked in the 1960s and levels of school attainment have been stable since the 1970s. Student achievement as measured by average SAT scores indicates a possible decline (pp. 12-13). Further, there is a long-term trend of a 3.5 per cent p.a. growth in per pupil cost (pp. 10-11). [The same point can be made about any labour intensive occupational area in the context of long-term rising real incomes and

living standards.] On the micro-side, inputs as measured by the prime determinants of spending per pupil – teacher-pupil ratio, teacher education, teacher experience – have risen but this is not associated with a clear-cut improvement in outputs (pp. 16-17).

'No consensus exists about what specific factors affect student performance', but 'there is overwhelming evidence that some teachers and schools are significantly better than others', even while holding such factors as socio-economic background constant (p. 18). [He therefore throws no light on this question, which is *the* crunch issue for micro-level education production function studies. Schooling post-Hanushek remains a 'black box', and policy-makers are left only with macro-level tools – Hanushek would replace governmental expenditures with incentive structures of a market economic kind, but his solution is no more sensitive to the specificities of production in this sector. Hence if his policy solutions have positive effects these are essentially inexplicable, ultimately random, and not necessarily repeatable in new circumstances.]

Hanushek goes on to claim that Hedges et al. [see below] confirm his analysis and dismisses as 'implausible' the findings of Card and Kreuger which demonstrate that there is a strong correlation between 'quality' of schooling as measured in terms of resource inputs, and earnings in the labour markets, for past generations of workers. Hanushek suggests that if such effects exist they may have diminished in recent years. Further, Card and Kreuger may have traced the effects not of schooling inputs per se but of associated variables such as parental wealth and motivation (pp. 20-21). He argues that his general findings vis a vis schooling should not be unexpected, as in schooling 'rewards are only vaguely associated with performance, if at all'. 'Incentives based on student outcomes hold the largest hope for improving schools', rather than centralised regulation and singular approaches to complex, varying problems (pp. 23-24).

Hedges, Larry, Laine, Richard and Greenwald, Rob (1994), 'Does money matter? A meta-analysis of studies of the effects of differential school inputs on student outcomes', *Educational Researcher*, April, pp. 5-14.

Hedges et al. critique the influential work of Hanushek. Hanushek summarised a large number of studies in the education production function tradition to deduce that there was no strong or systematic relationship between educational inputs (resources for teaching, etc.) and educational outcomes as measured by student test scores. This work has been used widely in both government and 'think tank' circles to discredit arguments for increased expenditure on education. For the purposes of the critique, Hedges et al. use the same data set as Hanushek – despite their reservations about it - but apply different methods of meta-analysis and reach the opposite policy conclusion.

The debate is largely technical with reference to policy implications only in the conclusions. Hedges et al. generally present a convincing case. For example Hanushek finds that while the majority of studies identify a positive relationship between resource inputs and educational outcomes, in many cases this relationship is not statistically significant. However, if there was no systematic relationship as he concludes, one would expect the findings to be more evenly distributed between positive and negative and for a lower proportion of results to be statistically significant (p. 6). They conclude in general that re-analysis using 'more sophisticated methods' than Hanushek's

confirms a strong and systematic positive relationship. The authors note that Hanushek is over-reliant on cross-sectional studies and it is now broadly agreed that longitudinal studies are more sensitive to school effects (p. 12). There is a reply by Hanushek and a further rejoinder by Hedges et al. in the May 1994 issue of *Educational Researcher*.

Hong, Doo-Seung (1997), 'Dynamics of Asian workplaces', *Work and Occupations*, 24 (1), pp. 5-11.

The article introduces the special issue of the journal on Asian workplaces, which seeks to explain the dynamism of East Asian economies. Explanations emphasise cultural factors, particularly the constitution of inter-personal relations and work motivation.

The early stages of industrialisation were marked by 'a light, labour-intensive, export-oriented industrial structure characterised by low-paid, unskilled, predominantly young female workers' (p. 5). Subsequently wages rose sharply, ahead of productivity, and an increasing proportion of production was moved off-shore. The role of life-long employment in Japan has been overstated. It is basically a phenomenon of the post-war period and is now receding (pp. 6-7). However performance-based remuneration is not widely used: it causes 'deep concern' in Japan because 'there is a shared feeling that coordination and harmony among group members are critical to human relations within workplaces' (p. 7). In general in East Asia, 'group oriented rather than individualistic attitudes in behaviour... are likely to raise productivity in firms' (pp. 7-8). There are varying attitudes to the co-worker, depending on country. Japan emphasises non-work social ties. China visualises 'an interdependent self' rather than 'an independent self' (p. 8) and emphasises kinship ties. Research focuses on *guanxi*, interpersonal ties based on 'particularistic criteria', with two or more individuals, a source of identity and information necessary to survival and success (pp. 8-9), and the relationship between *guanxi* and group cohesion. The meaning of *guanxi* may vary within the Chinese diaspora. The effects of *guanxi* based on family ties may be strongest. The more ties of *guanxi* that exist between two individuals, the greater the effect on work relations. Kinship ties seem to be more important in China than in Korea (p. 9).

In general, 'East Asian dynamic industrial flexibility seems substantially more autocratic than its counterparts in more industrially advanced countries' (pp. 9-10). Informal rather than formal methods of participation are used (pp. 9-10). There are shifts towards more industrial unrest and more individualistic modes of life (pp. 10-11).

Howell, David R. and Wolff, Edward N. (1992), 'Technical change and the demand for skills by US industries', *Cambridge Journal of Economics*, 16, pp. 127-146.

[This is an outstanding study and a key part of the literature on technological change.] The relative use of different categories of labour may depend as much on the technology and organisation of the workplace, as on the relative prices of capital and labour (p. 129). Recent studies have established that educated workers are more able to

adapt to changes in work organisation and job tasks that accompany technical change. There are limitations to this work: it fails to control for industry-specific characteristics, instead reading off trends in total factor productivity (TFP), and it assumes that educational attainments are synonymous with skill requirements in the workplace. However, most jobs require a variety of motor, cognitive and interpersonal skills, and these are also specific to the occupation concerned. Years of schooling are a poor proxy for such skill requirements. Further, the quality of schooling itself varies (pp. 127-128). In fact because jobs are heterogeneous the relevance of school attainment varies (p. 129).

> *In some occupations educational attainment may not be a direct measure of job-related skills, per se, but a device used to screen for the ability to learn on the job and for desirable social and personal characteristics* (p. 129).

[This point is convincing. It suggests that in the real world, screening behaviour/relations and human capital investment behaviour/relations co-exist and the mix is situation determined. For example, in job selection, applicants must meet base-level human capital requirements such as possession of the appropriate degree with the right knowledge, after that screening functions of education take over, for example in the appointment of applicants who went to the 'right' university or school.]

Both skills, and technical change, are multidimensional and require several measures (p. 142). The article develops a more complex model of the demand for skills. Howell and Wolff rank occupations on the basis of three different existing skill measures covering the cognitive, interactive and motor skill domains (p. 131) and report on the correlation of the job-based measures with educational attainment. Occupations and industries vary greatly in their mix of these skills, underlining the point about the inadequacy of single measures (p. 143). They emphasise that 'effective policy initiatives must be grounded in research that adequately captures the diversity of labour skills in the real-world workplace' (p. 144).

They then investigate various relationships. They find that cognitive skills and interactive skills are closely correlated to educational attainment, but there is a weaker relationship between changes in educational attainment, and changes in skill levels. There is a strong negative correlation between motor skills and interactive skills (p. 134). They find that factor prices [ie. labour costs] do not explain differences in skill requirements. They find that skill growth is closely linked to technical change but not productivity growth, which might be explained by 'the costly adjustments that often accompany fundamental changes in production' (p. 141). Further, while capital intensity is positively correlated to the level of interactive skills, it is inversely related to both cognitive and motor skills.

> *The relative growth in cognitive skills across industries since 1970 is closely associated with technical and organisational change, production in large plants, and low or negative growth in capital intensity, industry employment and import penetration. The growth in motor skills is also negatively related to increasing capital intensity, employment and import shares. But the results for interactive skills are just the reverse: growing capital intensity, employment and import shares*

are associated with increasing interactive skill levels. Unlike the results for cognitive skills growth, direct measures of technical change have mixed effects on interactive skill and motor skill growth (p. 141).

The share of professional and technical workers in industry employment grew fastest in industries with the most rapid technical change. With the transition to production methods based on information technologies, it appears to be increasingly true that it is technical change, rather than mechanisation *per se*, that increases the demand for cognitive skills (pp. 142-143). The empirical tests conducted by the authors support this surmise. 'Computer intensity, young capital stock, and high shares of engineers and computer specialists are all positively linked to cognitive skills growth, with very strong effects for the latter two variables'. But TFP growth was strongly negatively associated with cognitive skills growth, raising doubts about the adequacy of TFP as a measure of technical change (p. 144). Howell and Wolff also discovered a strong positive relationship between plant size (and its growth) and increased demand for cognitive skills: large plants are in the vanguard of those changes associated with increased cognitive skill depth. Interestingly:

We find that computer intensity is strongly associated with falling interactive skills and declining shares of managers and clerical service workers (p. 128).

This suggests that computer-based technologies may substitute for middle managers and supervisors. However, the data do suggest that interactive skills appear to be in greater demand in industries investing heavily in new capital (p. 144).

Hyland, Terry and Johnson, Steve (1998), 'Of cabbages and key skills: exploding the myth of core transferable skills in post-school education', *Journal of Further and Higher Education*, 22 (2), pp. 163-172.

The concepts of 'core', 'generic' or 'key' skills 'are now ubiquitous in educational discourse' and an integral aspect of policies and programs, for example in the core skill units of General National Vocational Qualifications. The authors argue that nevertheless, 'in the sense of free-standing, context-independent abilities', 'such skills are without philosophical or empirical support and are entirely illusory' (p. 163). There is no agreed or common definition of these skills, which are variously associated with specialised knowledges, outcomes of behaviour, ways of thinking, or the attitudes, values and personality traits of students. There is no such thing as general, transferable skills which are domain-independent (p. 164) – two decades of research have failed to produce any supporting empirical evidence (p. 169) - though there is no doubt that the concept has been immensely influential (p. 167). In relation to problem-solving skills:

There is no general routine, no one set of procedures, no algorithm that will at the same time *facilitate the solving of a chess problem, show people the way out of difficulties in personal relationships, diagnose an electrical fault and help sort out a difficult passage in Hegel* (p. 169).

Essentially, 'general skills' is a policy slogan. A concept with such unclear logical status and without precise definition or range cannot be expected to carry an educational programme (p. 166). Millions of young people have suffered inadequate vocational education and training because of wishful thinking about transferable skills. The promise of a flexible and adaptable workforce, and the best possible configuration of attributes in relation to an uncertain future, is compelling. However, 'the pursuit of such skills is a chimera-hunt, an expensive and disastrous exercise in futility' (p. 170).

Jovanovic, Boyan (1995), 'Learning and growth', *National Bureau of Economic Research Working Paper* No. 5383, NBER, Cambridge, MA.

There are four sources of growth of knowledge: research, schooling, learning by doing, and training. Even the most advanced countries spend far more on adoption of existing technologies than on inventing new ones. Part of the adoption cost of new technologies is creating the human capital specific to those technologies - the cost of training people, in school or on the job, to use that technology. Some costs are direct, others are forgone output. 'There are many types of human capital, each somewhat specific to a technology' (p. 2). With many different technologies and different human capital types, then it is not always optimal to pay the adoption costs (p. 2).

Jovanovic, Boyan and Stolyariv, Dmitriy (1997), 'Learning, complementarities and asynchronous use of technology', *National Bureau of Economic Research Working Paper* No. 5870, Cambridge, MA.

Most users of technology have not developed it themselves. They have adopted someone else's invention. Outputs can fall right after adoption takes place: 'it takes a while before productivity under the new method exceeds peak productivity of the old one'. Forgone output is an implicit cost of switching technologies. There are also explicit costs of switching technologies (p. 1). The study models processes that require several complementary inputs subject to improvements in quality. If after a quality upgrade one of these inputs requires a period of learning before it can be used effectively, then in general it will pay to purchase the inputs at different dates: the purchases will be asynchronous, ie not simultaneous. Otherwise funds would be tied up in inputs not fully utilised until the date learning is over. Technology has been used in this manner in the auto industry, TV, electricity supply, and railways among other industries.

Karmel, Tom (1996), 'The demand for secondary school', *Monash University-ACER Centre for the Economics of Education and Training Working Paper* No. 3, March, Monash University, Melbourne.

Karmel seeks to identify the economic factors that have affected the increase in retention to the end of schooling, as measured by age progression rates. The earnings attributable to end of school qualifications increased in the 1980s after declining in the 1970s. Labour demand shifted away from people with low levels of education, though the link between this and trends in school retention is not totally clear (pp. 5-7). Full-time employment opportunities for teenagers have declined, weakening employment as an alternative to schooling. Interestingly, trends in the availability of apprenticeships are not necessarily drivers of trends in retention: for example in the late 1980s there was strong growth in both apprenticeship commencements and retention to years 11 and 12 (p. 14). The increase in unemployment has played an 'important role'. Not only does it underscore the utility of qualifications, it reduces the opportunity cost of staying at school (p. 22). The costs of schooling have declined in two ways. First, the proportion of school children in part-time work has increased. Second, there was a substantial increase in government allowances in the mid-1980s. However, note that retention continued to increase after 1988 when major increases in the allowance ceased (p.15).

Kohler, Christoph and Woodard, James (1997) 'Systems of work and socio-economic structures: a comparison of Germany, Spain, France and Japan', *European Journal of Industrial Relations*, 3 (1), pp. 59-82.

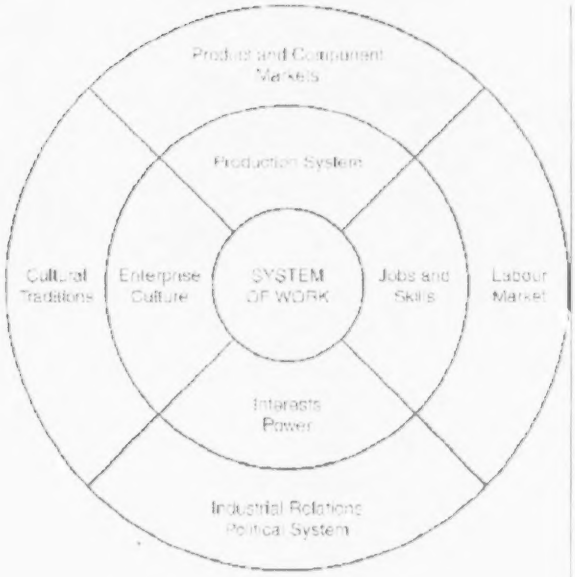
This very useful article focuses on mechanical engineering in Germany and Spain, with comparative reference to France and Japan. In all four countries machine building is typified by highly complex production processes, a relatively low level of automation and a high proportion of well-trained skilled workers. There is a high degree of similarity in job structures. 'The traditional machinist in this sector in all four countries has a wide field of action and comprehensive skills' (p. 62). Mechanical engineering is 8 per cent of industrial employment in Germany, 5 per cent in Japan, 3.5 per cent in France, and 2 per cent in Spain where it is concentrated in the Basque country, Catalonia and Madrid. France and Japan tend to more standardised products, larger production runs and larger companies than Germany and Spain. Germany has the least outsourcing.

Kohler and Woodard distinguish between systems of production (the organisation of production-related processes and functions) and systems of work (the organisation of individual tasks and performance) (p. 76). They also distinguish between the differentiation of *functions* and *tasks*.

> *Functional differentiation involves the separation of production-related planning and service functions from machining and assembly jobs on the shop floor. This separation can take the form of specialised job categories within the boundaries of the production departments (programmer, scheduler, quality controller) as well as*

the establishment of separate departments (process engineering, production control). Task differentiation involves the degree to which production workers are confined to single jobs or assigned flexibly to different tasks (pp. 61-62).

In France there is the greatest differentiation of functions and tasks. Production workers have little role in planning and service functions, and are largely restricted to their own machine or workplace. 'The work systems of the German plants are characterised by a lower level of both functional and task differentiation' (p. 62). This is shown for example in the greater participation of machinists in the programming of CNC (computer numerical controlled) machines; and 'while machinists possess individual work-stations they are assigned, much more frequently than their colleagues in France, to different jobs in order to cover absences, machine breakdowns or changes in the component mix. The ties of horizontal cooperation are thus much stronger than in France' (p. 63). In Spain formal organisation is similar to France, with a high degree of differentiation into separate organisational units, but informal organisation also plays a marked role and 'in the informal organisation of the production departments we found a high degree of functional integration, a quasi-craft structure', especially in the majority of companies which had proven slow to modernise. Spain combines 'Taylorist' bureaucratic elements - due to the sharp functional differentiation in formal organisation - with craft elements through the unintended integration of functions on the shop-floor. In practice machinists are more closely involved in planning and service functions than in Germany, but the Spanish worker is more confined to an individual machine, ie. task differentiation is low. In Japan data are lacking. There is a distinction between plants producing for the world market and for domestic markets. What data are available suggest functional differentiation is relatively high and task differentiation relatively low. Horizontal flexibility between work stations is even higher than in Germany. 'Japanese machinists are more frequently assigned several machines and more often leave their base job to assist other work stations and teams' (pp. 64-65). Kohler and Woodard argue these national differences are explained 'by contrasting economic, social and political structures', placing more emphasis on 'socio-economic' than 'socio-cultural' elements in the explanation (p. 65). Their explanatory model is as follows (p. 66):



Socio-Economic Context of Work Systems

The first circle in the centre symbolises the object of our analysis and dependent variable, systems of work. The second circle displays a first set of independent variables: subsystems at the micro (plant) level. The third circle consists of markets, institutions and networks at the meso (supra-plant) level ... all three levels are closely woven into social, economic and political structures at the macro level (p. 66).

In examining markets and systems of production [the North quadrant in the diagram] the authors distinguish between the social dimension of the organisation of production (the assignment of processes and functions to organisational units, the hierarchies in production etc.) and the technical dimension (the time structure of operations along the process chain). Historically, 'Taylorism' moved from social differentiation to include rationalisation of the technical dimension. In Spain the relatively low level of technical organisation - the protracted 'early Taylorism', prolonged by domestic protection - explains the high incidence of informal organisation. After World War Two machine building in Germany and France faced strong competition and adjusted 'by constant innovation and rationalisation', and these countries achieved a highly developed 'Taylorist' functional rationalisation and technical organisation. 'Social and technical organisation are mutually conditioning ... the strength of the German skill-based system of work derives to a certain degree from the support of a mature technical organisation' (p. 76). Japanese mechanical engineering faced both domestic competition and global competition and the resulting pressures to rationalise. 'Segments of Japanese industry were the vanguard of "post-Taylorist" process-oriented, inter-functional, "systemic" rationalisation' (p. 68).

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Variations in the supply of labour [the East quadrant in the diagram] also cause national differences in work systems. The authors share in the widespread support, evident throughout the literature, for the German model of training:

> *Germany, Austria and Switzerland developed an exceptional system of vocational and engineering training that is built upon artisan traditions and structures. At its base lies a dual system that still accounts for the education and training of more than 50 percent of young people. This system is split between classroom training (usually taking three years) at technical schools and practical work arranged by the private employer of the apprentices. The vocational schools are controlled jointly by the state, employers' associations and unions. This system offers scope to advance to higher-level technical and engineering schools; many engineers in German industry began their career as apprentices on the shop floor.*
>
> *Compared to other industrialised countries, the availability of multiple or polyvalent skills permits a high degree of functional and task integration in production. Workers are able to perform flexibly a large variety of tasks and to fulfil a multitude of planning and service functions. The technical offices for design, process and production planning and control can rely on a broad pool of practical and theoretical skills. This range of competences and the cultural proximity of workshop and offices enable feedback structures and mechanisms of organisational learning to develop, processes can be fairly accurately planned in advance, interfaces are more precisely defined and as a consequence the deviations between formal and informal organisation are smaller than in other countries* (pp. 68-69).

Spain never developed a system of vocational and engineering schools comparable to the German model: at best, large companies provided a basic level of in-house training and when public vocational schools began in the 1960s, most private companies abandoned in-house vocational training. Spain failed to develop a middle level of technical education, between basic vocational training and selective engineering sciences at university, so that in mechanical engineering the necessary skills had to be generated by on-the-job training linked to promotion structures. In the 1980s middle-level technical education developed but the new supply of well-educated engineers has been absorbed only slowly because of declining industrial employment. The old promotional ladders are gradually disappearing.

> *International comparisons of work systems have shown strong interdependence between the educational system on job structures: the less vocational training and the lower the level of available skills, the more differentiated is the organisation of work. Narrowly defined jobs and career ladders allow for incremental on-the-job training in internal labour markets and thus to a certain degree can substitute for public vocational training. In Spain these mechanisms have contributed to the bureaucratic and hierarchical formal organisation and to narrowly defined job classifications. This logic is however counteracted by the unintended reintegration of planning and service functions in production which forces highly complex tasks like correction of drawings, machining sequences and scheduling into production*

work. Spanish production workers, tied by a rigid task differentiation to their individual machines, had to develop comprehensive craft-type knowledge empirically on the job (p. 69).

France developed a comprehensive public system of vocational training and engineering schools earlier than in Spain. It was 'hierarchically segmented and rather impermeable for upward mobility'. On-the-job training and long career ladders from shop floor to planning and design gave way to segmented internal labour markets, with a polarisation between technically trained staff and 'practitioners or empiricists in production' (p. 70). The Japanese system of technical training is also school-based, segmented and hierarchical but, unlike France, Japan retained 'its old and well-established system of broad and systematic on- and off-the-job in-house training with its extensive horizontal and vertical mobility paths from the shop floor to top management'. Graduates of technical high schools with some vocational training, and recruits from technical and engineering schools, enter production jobs. Advanced technical and engineering degrees are a precondition but not a guarantee of promotion up to the technical offices and key company positions. 'Compared with the skilled German worker there are deficiencies in theoretical and empirical knowledge, partially but never fully compensated by the Japanese system of on-the-job training. The Japanese educational system and the characteristics of the labour supply support functional differentiation with the strict separation of planning, service and production functions' (pp. 70-71).

Differences in the structuring of power and interest [the South quadrant] also shape variations in work systems. In Spain 'employees in the protected sector' in public administration and the stable industries 'developed a strong interest in regulation which imposed rigid demarcations in the internal labour market in order to neutralise internal and external competition' (p. 71). The fragmentation and differentiation of job functions also enabled nepotism, ie. the extension of employment to family and social networks. 'Mechanisms of this kind are typical in all industrialised countries. They become more prevalent the stronger the vertical differentiation of the external labour market according to income and employment security and the stronger the predominance of internal labour markets' (p. 72). In Germany the low level of unemployment reduced the differentiation in the external labour market, while machine-based companies generated internal labour markets that were both open and skill based. Craft qualifications were transferable between firms and job security depended more on the health of the sector than on single employers. Compared to Spain there was less pressure to differentiate functions and tasks in order to create/protect jobs. France and Japan stand somewhere between. 'In Japanese machine-building the high employment stability of the core workforce in large and medium-sized companies gave high security to this stratum of workers and permitted flexibility in job assignment (low task differentiation)' (p. 72).

Cultural traditions [the West quadrant] also affect work systems, particularly work ethics, and the element of 'trust' in labour relations. The German virtues of diligence, punctuality and discipline translate effectively into 'the profit-oriented abstract regime of capitalism', and corporatist industrial relations have enabled high trust. These qualities lead on one hand to 'competent planning and efficient coordination and control

of the chain of production processes', on the other to 'functional integration and relative autonomy on the shop floor... Complex tasks of the planning, service and control function can be given to production workers without the risk that they will exploit this power in bargaining processes'. In Spain there is a less modern ethic and less trust, encouraging the dualism of formal differentiation/informal integration, less planning and 'a pragmatic muddling through'. Less trust is compensated by rigid bureaucracy but this contradicts the Spanish worker's high level of informal autonomy (pp. 72-73). France has a more modern work ethic than Spain but less trust than in Germany, encouraging the strong separation of planning and execution, and 'the relatively limited autonomy of the French production worker'. In Japan modernisation - linked to traditional clan structures - generated both a high degree of 'abstract' work ethics and a system of industrial relations based on high trust, enabling relatively high autonomy and flexibility. However, this leaves unexplained the stronger separation of conception and execution in work systems, as compared to Germany. Cultural variables are not always decisive. The cultural quadrant has a secondary significance, compared to markets and the production system, the educational system and the labour markets, and interests and power structures.

In the 1980s and 1990s the introduction of computer technologies is associated with far-reaching changes in all four countries, manifest in both segmentation of production and outsourcing, and stronger integration and networking. 'In all four countries, attempts were made to reintegrate functions and tasks (programming or program optimisation, maintenance, logistics, quality assurance) into production jobs and to make job assignments more flexible... It is very likely that a new 'post-Taylorist' model will emerge, defined by higher levels of automation and a lower level of functional and task differentiation'. Globalisation pressures may entail that there is less national variation around the 'post-Taylorist' model than previously. 'Taylorist' modes were characterised by differentiation in both production functions, and work tasks. 'Post-Taylorist' models may be characterised by further differentiation of function but greater integration of work tasks, *or* greater integration of production functions accompanied by increased differentiation of the work system (pp. 75-76).

In summary, the authors emphasise the common elements between the national production systems: 'national and regional differences represent modifications of a common underlying structure' in which markets, products and organisational systems are closely inter-dependent. 'Societal effects' render only modifications. However, these can be highly significant for enterprise productivity and competitiveness. The 'societal effects' are strongest at the meso and macro level of economies. 'Within the post-Fordist regime in Europe we can identify a nation-specific matrix of mass production, mass consumption and the welfare state at the macro level; a close connection between the sectoral mix of industries and the social and institutional environment (educational system, labour markets, science and research, industrial relations, industrial policy) at the meso level; and finally strong interdependences between market segments and the organisational structure of companies at the micro level' (p. 77).

> *The challenge we are facing today is to comprehend the transformation into new patterns without having fully understood the old* (p. 77).

Lafferty, George, Hall, Richard, Harley, Bill and Whitehouse, Gillian (1997) 'Homeworking in Australia: an assessment of current trends', *Australian Bulletin of Labour*, 23 (2), pp. 143-156.

The authors provide a definitive summary of available data on home-working in Australia, using Australian Bureau of Statistics (ABS) supplementary labour force surveys conducted in 1989, 1992 and 1995. These ABS data are deficient. They are subject to sampling error which affects industry disaggregation, and 'the survey data unavoidably understates the level of home-working to a considerable extent' (p. 144). The September 1995 ABS survey found that there were 343,300 people working at home. However, the ABS data tend to exclude people working informally or illegally (eg. evading tax, or afraid of losing welfare benefits, or illegal migrants, or working outside award structures) and thus substantially understate the role of non-English-speaking background and women workers, especially in the clothing industry. A recent study by the Textiles, Clothing and Footwear Union estimated that there were approximately 329,000 clothing outworkers, with 144,000 in Victoria and 120,000 in NSW. These estimates should also be treated with caution.

Lafferty et al. note that home-work tends to be interpreted according to two arguments. First, it is seen as a more flexible method of work organisation in a post-industrial society; second, it is seen as an exploitative outcome of competitive pressures in a globalised economy. The reality is more complex [and encompasses both elements]. Certainly the shift in manufacturing in favour of low wage economies, and the use of outworkers and outsourcing as cheaper forms of labour, have contributed. 'A further factor contributing to the expansion of home-working has been the increasing sophistication and accessibility of computer technology, particularly in new areas such as telework (work using information and communications technology)'. However, not all of the trend to telework is voluntary. As both public and private organisations have reduced their workforces, 'many former employees have turned to working from home as a means of securing a livelihood' (pp. 143-144).

Home-working occurs under a variety of relationships involving workers, employers, and various intermediaries or sub-contractors. 'These relationships are often used by employers to disguise the presence of an employer-employee relationship and thereby to avoid their legal obligations with respect to employee rights' (p. 144). Home-workers work under very diverse conditions. The ABS defines home-based workers as those who work more hours at home than elsewhere during the survey period. In 1995 the 343,300 people represented only 4 per cent of the workforce, but the number of home-workers had grown by 29 per cent since 1989. In 1995, 11 per cent were employers, 37 per cent were paid employees, and 53 per cent were self-employed, unpaid family helpers or paid in kind. The proportion who were employees had grown slightly since 1989. Women were 70 per cent of home-workers in 1989, and 67 per cent in both the 1992 and 1995 surveys. In 1995 female employment at home was 6.4 per cent of all employed women, compared to 2.4 per cent of men. People in older age groups were more likely to be working at home: 17.5 per cent of home-workers were aged 55 years or more, compared to 9 per cent of all employed persons (pp. 145-147). There were few recently arrived migrants in the ABS data, underlining the point about data deficiencies.

Of the women who worked at home in 1995, 24 per cent cited childcare responsibilities (compared to 2 per cent of men) and 12 per cent mentioned the desire to help their spouse. In fact, 31 per cent of men stated that they were saving on office costs, compared to 12 per cent of women.

Over one third of male home-workers are professionals and 22 per cent are tradespeople. Only 13 per cent of women are professionals and less than 6 per cent are in trades. Over 20 per cent of home-workers - and 30 per cent of male home-workers - were located in finance, insurance, property and business services; 15 per cent in wholesale and retail trade, 15 per cent in construction, and 13 per cent in manufacturing. Construction is a growing area of home-work, accounting for 19 per cent of home-worker women in the survey. The role of men home-workers in transport, storage and communications has increased markedly. 'The largest single group of home-workers comprise clerks working in the construction industry' (43,500) of whom almost all are female' (p. 152). About half the female clerks in both construction and retail are self-employed and 30 per cent are employees, and the authors conclude that many are assisting their spouses in running businesses from home (pp. 150-152).

No data are provided on the level of training. The authors note that 60 per cent of all home-working employees are paid an hourly rate and 56 per cent work less than 30 hours a week. In 1995 almost 70 per cent of home-worker employees were casual employees - as opposed to 24 per cent of total Australian employees - whereas 56 per cent of home-worker employees were casual in 1992. Only 3.7 per cent were union members in 1995, compared to 7.4 per cent in 1992. In addition, 58 per cent of home-worker employees were covered by employer-financed superannuation compared with 87 per cent of all Australian employees. They conclude that home-work is clearly expanding, and 'increasing numbers of home-workers are also becoming marginalised' (p. 154). 'Considerable further research is required to provide adequate indications of the qualitative and quantitative dimensions of this area of home-working in Australia, in order to indicate appropriate strategies for improving the conditions experienced by the most vulnerable of workers' (p. 155).

Lawrence, Robert Z. (1997), 'Current economic policies: social implications over the longer term', in Organisation for Economic Co-operation and Development, *Social cohesion and the globalising economy: what does the future hold?*, OECD, Paris, pp. 27-38.

Lawrence presents data on growing inequalities, and unemployment problems. In the US poverty rates for children fell from 27 to 14 per cent between 1960 and 1973, but rose to 23 per cent by 1993. There has also been 'a noteworthy reversal of the progress made between 1962 and 1973 in closing some of the gap in earnings between white and black Americans, and a noteworthy decline in black male labour force participation' (p. 29). All developed countries have seen a shift in demand away from unskilled work (p. 29). The number of people employed in the Fortune 500 companies declined from 17 million in 1980 to 11.5 million 'currently' (p. 30). The main redistribution has not been from labour to capital but from unskilled to new technology-skilled educated workers. This is hard to reverse (p. 31). But 'an increase in the relative supply of skilled workers

could reduce skill premiums if workers are induced by the rise in the skill premium to raise their investments in education and other forms of human capital' (p. 33).

The productivity slowdown needs more research (p. 30) [but note this is due to changes in exchange value rather than use value]. 'The fate of citizens, particularly the poor', rests increasingly not on government performance but the performance of market forces (p. 32). This makes the future particularly difficult to predict (p. 37).

Le, Anh T. (1995), 'Self-employment in the Australian labour market', *Labour Economics and Productivity*, 7 (2), pp. 127-148

Government programs such as the New Enterprise Incentive Scheme, directed to the unemployed, encourage the growth of self-employment. There are many similar programs in the UK, USA, France and elsewhere. The author uses time-series data to provide an overview of the development of self-employment opportunities for 1978-1994, and cross-sectional data from the 1991 Census to provide an account of the influence of personal and job-specific variables on self-employment choice. Both individual characteristics such as educational attainment, and group characteristics such as patterns of language use, affect variations in the propensity to self-employment.

The 1978-1994 data found that the self-employed constituted 14-16 per cent of all the workforce throughout the period, reaching 1.218600 million in 1994 (p. 131). The 1991 cross-sectional data find that the mean school leaving age is 15.96 years: those who left school earlier than this have self-employed rates of 20 per cent (p. 133). The most common qualification among the self-employed is 'skilled vocational': individuals with that qualification have a self-employment rate of 25 per cent (p. 134). In terms of industries, the rate of self-employment is highest in primary industry (62 per cent) and construction (40 per cent) followed by recreation (21 per cent) and finance (20 per cent). It is very low in communication (1 per cent) (p. 136). In terms of occupation, the major groups are managers 47 per cent, tradespersons 24 per cent, and professionals 16 per cent. Clerks are 14 per cent (p. 137). Self-employment is higher among non-Australian born people, especially those from Europe, the former USSR, Western Asia and North-East Asia (p. 139).

Leigh, Duane E. and Gill, Andrew M. (1997), 'Labor market returns to community colleges: Evidence for returning adults', *The Journal of Human Resources*, 32 (2), pp. 334-353.

The role of American community colleges is under-explored by labour economists, policy analysts or national media. This is partly because census data do not distinguish two-year and four-year courses. However, they are coming under more attention due to their increasing vocationalism – community colleges are less exclusively focused on the role of stepping stone to four-year colleges and universities – and their increasingly entrepreneurial character in their role as principal provider of adult training. For example, many such colleges offer non-degree short programs for adults and work with

employers to develop customised technical courses designed to train students to meet the particular skill requirements of local firms (pp. 336-337).

A previous study by Kane and Rouse (1993) established that enrolment in a two-year or four-year college program increases earnings by 5-8 per cent per year of college credits, whether or not a degree is achieved. This has provided the basis for policies increasing access by adult workers to long-term education and training programs. In 1995 President Clinton proposed to eliminate all existing adult training programs and shift the money into skill grants enabling eligible workers to pay for post-secondary education and training programs of their choice (p. 335). But the question is whether this result holds for experienced adult workers returning to school. Leigh and Gill use National Longitudinal Survey data for 1993. They find that the policy conclusion of Kane and Rouse does hold: results are essentially the same for both returning adults and for continuing high school graduates. Relative to high school graduates, the estimated differential for males is 18.9 per cent and females 4.4 per cent. The exception is one that favours adult males: among adult males in non-degree programs, there is an incremental earnings effect 8-10 per cent higher than that received by continuing students (pp. 342-345). They conclude that:

> *We view these results for males, in particular, as strengthening the case for public policies, such as the proposed Reemployment Act of 1994, designed to combat structural employment by increasing access to long-term education and training programs for adult workers* (p. 351).

Levin, John (1998), *The buffered or buffeted institution: globalisation and the community college*, Center for the Study of Higher Education, University of Arizona, paper presented to the annual meeting of the Association for the Study of Higher Education, Miami, FA, November.

The paper focuses on the extent and the ways in which globalisation has affected organisational behaviours, processes and structures in community colleges in Canada and the United States. Globalisation promotes technological change, vocationalisation, market responsiveness and a closer relationship between education and industry. It has economic, cultural, information and political aspects (pp. 21-22). There are 1200 US community colleges and 125 colleges in Canada: study focuses on the Pacific/Western region. Levin has used five case studies, with intensive interviews, document analysis and observations. Two rounds of visits were carried out at each site. He has focused on manifestations of internationalisation and cultural diversity, the changing use of electronic technologies, the drive to improved productivity and efficiency, aspects of state intervention, the impact of changes in labour conditions, public sector restructuring, and commodification. The outcome of the study is a rich description of each institutional context and the pressure and changes that are manifest. The institutional experience of, and response to, globalisation is rich and complex.

The author finds that the colleges are both protected from, and open to, the influence of global pressures and forces. Governance and labour relations structures provide some 'buffers'. Government provides both 'buffering' and buffetting' aspects

(pp. 22-23). Among the case studies one institution is notably 'buffered', another notably 'buffetted', and the other three are more intermediate cases (pp. 23-24).

Lynch, Lisa M. and Black, Sandra E. (1995), 'Beyond the incidence of training: evidence from a national employers' survey, *National Bureau of Economic Research Working Paper* No. 5231, NBER, Cambridge, MA.

[For additional detail see the note on Black and Lynch, *NBER Working Paper* No. 6120 which is taken from the same body of work.]

The authors use data from the Educational Quality of the Workforce National Employers Survey of employers. This covers employers with 20 or more employees. 'Formal training in this survey was defined as structured training that was offered at the establishment or at another location, and could occur during working hours or at other times. Structured training included all types of training activities that had a predefined objective'. Respondents were also asked about the incidence of unstructured or informal training: 'training where employees learn by observing others doing the job, or are shown how to do a job in an informal one-on-one situation by supervisors, co-workers or others' (p. 7). In fact, 81 per cent of all establishments offer some type of formal training: 57 per cent state that the amount of formal training has increased since 1990, 41 per cent no change, 2 per cent decrease. The largest establishments (over 1000 employees) are much more likely to report training than the smallest establishments (less than 100).

Proportion of establishments offering formal and informal training, by size of establishment, USA 1994

Number of employees	Formal training %	Informal training %
20-49	75	96
50-99	82	99
100-249	90	98
250-999	90	99
More than 1000	99	98
All establishments	81	97

Virtually all report informal training and variation in the simple measure used in the survey is not very explanatory (p. 7). Overall:

> *Employer provided training is a complement rather than a substitute to investments in physical and human capital. In addition, there seems to be evidence of a virtuous circle in human capital investments. Employee investments in schooling are then augmented by employer investments in training* (p. 29)

> *There are significantly positive effects on establishment productivity associated with investments in human capital. Those employers who hire better educated workers have appreciably higher productivity. That is true for both the*

manufacturing and non-manufacturing sectors...In addition, those employers in the non-manufacturing sector who use a measure of education quality (grades) in their recruitment of new production or front line workers experience higher productivity than their competitors (p. 30).

Our results suggest that formal training outside working hours has a positive effect on productivity in manufacturing, while computer training raises the productivity of non-manufacturing establishments (p. 30).

The incidence of training is relatively low in the textile and apparel industry, construction, transport services, and wholesale and retail trade. It is high in the chemical, petroleum and primary metals sectors in manufacturing and communications, utilities, finance and insurance in non-manufacturing (p. 8). Establishments with a higher capital/labour ratio are more likely to provide formal training programs (p. 10). There is significant variation in types of training programs by industry. Over 80 per cent of establishments in utilities, finance, insurance, chemicals and petroleum products offer computer skills training, but only 30 per cent of establishments in the retail sector. Literacy, numeracy and basic education is offered by less than 20 per cent of employers in business service, retail and construction sectors, but over 50 per cent of employers in utilities, finance, insurance and primary metals offer this type of training. Over 75 per cent of establishments in utilities, finance, insurance, chemicals and petroleum products pay for or provide teamwork training and over 35 per cent of employers in the construction industry offer this type of training (p. 13). 'Higher average educational level of workers at an establishment is positively linked to the provision of computer and teamwork training' (p. 14). In fact, 71 per cent of formal training takes place during working hours (p. 20).

Sources of training vary, with 50 per cent of establishments using equipment suppliers or buyers and 36 per cent private consultants, compared to 34 per cent using industry associations. Technical and vocational institutions (33 per cent), community and junior colleges (30 per cent) and four-year colleges or universities (20 per cent) were less important (Table 5).

In non-manufacturing, establishments that cite grades as an important priority in hiring also have higher productivity. For most employers applicants' grades are a low priority. In manufacturing, the use of communications skills as a priority criterion in hiring decisions is also significant in raising productivity (p. 26). Labour turnover has a negative impact on productivity, especially in non-manufacturing. Turnover is high in non-manufacturing. 'In non-manufacturing, unionisation has a positive and rather large effect on establishment productivity'. Neither TQM nor benchmarking appear to have any impact on current productivity of establishments, though there is a link between those practices and training practices. This may be due to lags between the introduction of such practices and their positive effects in productivity (p. 27).

Mason, Geoff (1996), 'Graduate utilisation in British industry: the initial impact of mass higher education', *National Institute Economic Review*, 2/96, No. 156, pp. 93-101.

Mason draws on a study of graduate deployment in the two British industries of steel manufacturing and fiscal services to investigate (a) the extent to which, given the growth in graduate numbers, the employment of graduates is substituting for non-graduates; (b) where such substitution occurs, the extent to which it is associated with job enrichment and higher quality work performance; (c) the extent to which the skills and knowledge acquired by graduates are under-utilised (p. 93).

Both industries are under pressure to simultaneously reduce costs, meet higher standards, and meet the needs of a diverse range of customers. This had led to an increase in demand for graduates relative to other levels of qualification. In steel the graduate share of total employment is increasing by 0.5-1.0 per cent per annum (p. 96). Possession of a degree is seen as a sign of cognitive and problem-solving capacities. These qualities need to be combined with interpersonal, communication and teamwork skills. The relative increase in demand for graduates is also fed by technological change. The influx of graduates has led 'many enterprises' to reorganise old 'high level' jobs to bring their holders closer to production and marketing, and to create new 'high level' jobs. Up to a fifth of all new graduates employed by sample steel plants entered new upgraded jobs, with better salary and career prospects than non-graduates. This suggests that graduates are 'under-utilised' only if there jobs have not been modified to use graduate skills and knowledge, and there is no salary premium for graduates (p. 95). Using this definition, under-utilisation of graduates in steel appears minimal (p. 96).

There is a much wider dispersion of starting salaries in financial services, than in steel. This is because there is 'streaming' of graduates in finance: there is now a lower tier of graduates explicitly recruited to the mid-clerical level. This is seen by some employers as a response to weaknesses in the quality of some graduate applicants, lacking either technical knowledge or personal skills such as communication, numeracy, maturity, capacity for initiative, or 'commercial awareness'. Some of the 'lower-tier' graduates are expected to make their way into the 'upper' streams in future; others are regarded as suited to routine jobs requiring little training (p. 97). Up to 45 per cent of all new graduate recruits have taken clerical, cashier and similar jobs. There is clearly substitution of graduate for formerly non-graduate labour, but some employers expect graduates to perform better, using problem solving and inter-personal skills (p. 98).

The author concludes that in future there will be continuing high demand for graduates relative to non-graduates, coupled with a growing polarisation in graduate jobs (p. 99). He suggests, without providing data, that institution attended is an important second 'qualification'. He does not make sufficient use of the industry studies to illustrate his argument, either by citing cases studies or providing aggregate data.

Mason, Geoff and Finegold, David (1997), 'Productivity, machinery and skills in the United States and Western Europe, *National Institute Economic Review*, 4/97, No. 162, pp. 85-98.

A series of studies carried out at the National Institute of Economic and Social Research has identified links between inter-country differences in the skill level of intermediate technician, supervisory and shopfloor roles, and relative labour productivity. The USA is a puzzle, however. It combines an aggregate productivity slowdown, high productivity in manufacturing, and highly criticised education and training below four-year degree level. Scale economies are one reason for this. There are also variations in the organisation of production, training and skill deployment. The authors compare matched samples of firms across the USA, UK, Germany and the Netherlands, in food processing and precision metalworking.

The continental European firms provide longer formal training periods and require process workers to switch between more areas of operation. The USA and UK are more Taylorist in approach. However, this potential rigidity is offset in engineering in the USA by 'a rather dynamic, open-ended approach to informal on-the-job training of the most capable members of the workforce, with machinists being pushed to continue learning new machines and products to the limits of their ability'. In some cases machine-setters will continue to receive training over three to five years. [NB. Informal training is less portable, hence less 'general' in Becker's sense, so that the benefits are more readily confined to the firm providing the training.] In addition a third of the American plants had launched comprehensive adult training programs to improve basic and technical skills. It is possible that the longer period of basic education experienced by semi-skilled American workers, as compared to British workers, renders them more 'trainable' on-the-job (p. 94). In America, 20 per cent of supervisors hold four or two year college qualifications, mostly in engineering or business, while the majority are not vocationally qualified. In Britain they are 85 per cent craft-skilled, in the Netherlands 50 per cent are technically trained, 50 per cent craft trained. The USA supervisors with college qualifications include some who have earned their degrees part-time with the employer paying all or part of their tuition costs. Some technicians and engineers have followed this route, also. Graduates appear to play a flexible, highly interventionist role in production in many plants, both routinely organising semi-skilled work groups, and acting as a mobile team of trouble-shooters/problem-solvers (p. 95).

Generally, American enterprises have access to a relatively large supply of engineering graduates, and this helps to compensate for deficiencies at lower levels of vocational education and training. Compared to Europe they lack craft-skilled shopfloor workers and supervisors. The typical American combination of semi-skilled workers with graduate engineers fits with America's larger scale of production, where there is more specialisation, and less flexibility of roles is required from workers (p. 96).

[Even in an age of more varied and customised product lines, requiring multi-skilling and regular changeovers of product, the American domestic market is so large that each of the many specialised product variants is produced on a mass scale. Thus what in other countries necessitates post-Fordism, in America can still be produced along Fordist lines. The American scale economies are not replicable, and the relative

inflexibility of labour would emerge as more of a disadvantage in other settings. This suggests that the American advantage is not readily transferable or generalised.]

McConnell, Sheila (1996), 'The role of computers in reshaping the workforce', *Monthly Labor Review*, August, pp. 3-5.

This is a brief introduction to other articles in the same issue on the impact of changes in information and communications technologies. In passing she notes that:

> *Computer technology has created economies of scale for many service industries, but more interestingly, has generated a secondary effect called 'economies of scope'. Many service producers have found that computer technology enables them to offer more services and attract a larger range of customers. (For example, commercial banks are able to offer several methods for their customers to access their accounts, such as automatic teller machines, debit cards and personal computers)* (p. 4).

Metcalfe, J.S. (1995), 'Technology systems and technology policy in an evolutionary framework', *Cambridge Journal of Economics*, 19, pp. 25-46.

Metcalfe develops 'an evolutionary theory of technology policy' and connects it with the literature on national systems of innovation. 'The pattern of technological innovation depends on much more than the behaviour of individual firms', he argues. Their activities need to be supported 'by the accumulation of knowledge and skills in a complex milieu of other research and training institutions' (p. 42). Stimulating the technological innovative capacity of the economy is 'a central purpose of policy'. The focus is not so much on market failure *per se* as on the enhancement of competitive performance and promotion of structural change. This includes 'enhancing the learning process in firms and other institutions to generate variety in behaviour' (p. 28).

There are three broad categories of learning. 'This diversity in sources of innovation experiments is central to the evolutionary approach to technological change'. Not all learning activity is carried out through formal R&D though policy is often concentrated on this dimension. Note also that successful innovation requires learning about markets and user needs, as well as learning about technology (p. 32):

- Learning by doing and using;
- Learning which involves interaction with external sources of knowledge located in other institutions, including other firms as suppliers or customers, science and technology agencies, etc.;
- Learning which is internal and directed, typically organised around a formal R&D program. (p. 32).

Innovation is neither 'technology push' nor 'demand pull'. It is a complex and contingent blending of the two (p. 37). Metcalfe argues that understanding the nature of technology is a key to successful technology policy. In general, technology is 'the ability to carry out productive transformations: the ability to translate materials, energy and/or information in one set of states into another more desired set of states. 'It is vital to distinguish technology as three interdependent forms: as knowledge, as skills and as artefacts'. Policies can be designed to influence each of these aspects separately, although in most circumstances all three elements are jointly produced.

> *The artefacts dimension, products and their methods of production, 'technique' as it is often called, is the central concern of firms which develop new and improved artefacts in the search for competitive advantage. The skills and knowledge necessary to underpin technique are also the concern of firms but they are also produced by a much wider set of institutions. In fact, the central fact about the modern process of innovation is that it is based on a division of labour, as Adam Smith clearly foresaw when he wrote about the role of philosophers and men of speculation. Division of labour produces efficiency gains from specialisation and professionalisation but it also requires a framework to connect together the component contributions of different agents. As far as knowledge and skills are concerned this aspect of connectivity, or technology transfer, cannot be effectively coordinated by conventional markets... the connectivity of technology-producing institutions should be a central concern of technology policy* (p. 34).

Policy can either stimulate firms to broaden their own innovative potential within a larger horizon of innovation, or shift that larger horizon outwards.

> *A national system of innovation is that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process... it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies. The element of nationality follows not only from the domain of technology policy but from the elements of shared language and culture which bind the system together, and from the national focus of other policies, laws and regulations which condition the innovative environment* (p. 38).

Michalski, Wolfgang, Miller, Riel and Stevens, Barrie (1997), 'Economic flexibility and social cohesion in the twenty-first century: an overview of the issues and key points of the discussion', in Organisation for Economic Co-operation and Development, *Social cohesion and the globalising economy: what does the future hold?*, OECD, Paris, pp. 7-25.

Profound and unanticipated transformations and tests of human adaptability are not a virtue in themselves. 'Most people prefer a world where life is characterised by stability, continuity, predictability, and secure access to material well-being' (p. 7). Yet

many OECD country economic policies 'encourage the productive turmoil of relentlessly competitive markets' (p. 7). There is a tranquillity/ prosperity trade-off. [Is the level of prosperity sufficient to justify this claim?] A strong social fabric is necessary, to provide a secure basis for flexibility and risk taking (p. 7). But 'there is a strong sense of worsening social circumstances for large segments of OECD populations'. Unemployment is high in Europe and mounting in Japan, problems of social exclusion and growing insecurity are manifest in almost all OECD countries but governments are unlikely to shift the current economic policies (p. 8). However OECD economies might be 'on a much faster growth trajectory twenty years hence if [!!] productivity payoffs from the diffusion of new technologies, market liberalisation and globalisation come on stream' (p. 9); this would create more room to move on the social front. The more likely scenario is the slow growth of productivity and production and incomes with virtually no growth in the labour force (p. 9).

> *With labour, goods and services markets exposed to deregulation, globalisation and technological change, there may be greater volatility and pliability in response to a full range of intense competitive pressures* (p. 10).

The promotion of 'domestic and international competition' [note that there is no distinction made here] will augment growth 'by accelerating the introduction and diffusion of productivity enhancing innovation' (p. 20). The 'swiftly emerging global information infrastructure will greatly facilitate access to economic information such as prices and product' (p. 11).

> *It is expected that many of the technical as opposed to state-imposed obstacles to market functioning, like the cost of accurate and timely information for making transaction choices, will be largely overcome by the emerging power of the global information infrastructure* (p. 16). [But doesn't this allow the planning capacity of the state to be revisited, eg. the Hayek debates at the LSE in the 1930s?]

In summary, 'markets and competition will become more important' (p. 11). There may be a shift to flatter structures, and independent entrepreneurship. The authors imagine work as becoming more autonomous and innovation-intensive. 'Just-in-time production of just-invented products will require highly efficient information, demand and supply networks' (p. 11). They also foresee a more culturally diverse world with more 'rubbing elbows' and a proliferation of specific identities once suppressed or absent. Homogenous national identities will give way to 'a fragmentation of cultural aspirations and values' (pp. 12-13). The welfare state needs to be transformed 'by shifting from a social expenditure to a social investment perspective' (p. 14). If societies develop further on highly individualistic lines, 'all segments of society will need to be able to share the dream of eventually being a winner – a common, unifying belief in success that cushions the reality of extreme inequality' (p. 16). However, trust is needed for markets to function effectively, and unlimited market power plus weak collective institutions could lead to a regressive combination of 'uncompetitive monopoly or collusive behaviour in the market-place and risk-adverse defensive behaviour among individuals' (pp. 16-17).

In a more solidaristic scenario localisation of government would occur, serviced by global information infrastructure, and community-to-community redistributive policies. Information is the key to the regeneration of political participation. But participation, tolerance of others' views and diversity may contradict the need for 'common views and values', ie. the social homogeneity on which solidarity depends (p. 18). [Isn't toleration of difference intrinsic to social solidarity?] A key issue is 'how to promote the sense of belonging, trust and security that are central to social cohesion' (p. 19). Here 'there is likely to be an indispensable synergy between governance systems that encourage social responsibility and the trust needed for the success of both a decentralised, innovation driven economy and more flexible social orders' (p. 22). The policy problem is to foster decentralised, autonomous, local services without 'blunting' market signals and incentives or losing the necessary social solidarity (p. 23).

> *Work reorganisation, in its many dimensions from teams and non-hierarchical workplaces to decentralisation and telecommuting entrepreneurs, is expected to be one of the fundamental growth forces likely to demand new ways of managing individual corporate and social risks. Technological developments, and not only in the fields of computers and telecommunications, will encourage growth while also contributing to turbulent and unanticipated changes in what, how and where people produce and consume. Continued globalisation, with its greater interdependence and positive impact on technology diffusion, trade and growth in general, will also demand considerable economic, social and even cultural adaptation* (p. 21).

> A second set of crucial changes concerns learning systems in general and the more narrow question of urgently reforming existing state-dominated education. Again, the most fruitful direction points towards greater recognition of diversity and improvements in transparency. Practically, this should lead to better validation of different types of learning throughout life (home, school, work) and clearer incentives for investing (even on borrowed financing) in the accumulation of human capital. In much the same way as firms are reorganising work and business strategy, sources and uses of learning could be more diversified, decentralised and consumer-driven (p. 24).

Miller, Paul and Mulvey, Charles (1997), 'Computer skills and wages', *Australian Economic Papers*, 36, No. 68, June, pp. 106-113.

The authors use 1993 ABS survey data to demonstrate that 52 per cent of males and 60 per cent of females had at some time used a computer. Analysis using earning functions shows that computer usage is associated with a wage premium of 12-16 per cent (p. 106). Computer usage is associated with about 13 per cent higher earnings for males and 16 per cent for females. For people with computing skills, there is on average stronger wage growth and additional years of job tenure. This is comparable to the wage premium associated with English-language proficiency, and with male vocational skills. 'Computer skills appear to be a better investment than completion of high school for

early school leavers' (p. 112). They might explain the observed increased dispersion of earnings in recent years [linking to the binary social and economic effects of technological change].

Similarly Kreuger (1993) found that in the US, the wages of workers who used computers tended to be 11-15 per cent higher than the wages of those who did not (p. 106). He estimated that the growth of computer usage accounted for up to half of the increase in the rate of return to education in the second half of the 1980s (p. 106).

Morrison, Catherine J. (1997), 'Assessing the productivity of information technology equipment in U.S. manufacturing industries', *The Review of Economics and Statistics*, 76 (3), pp. 471-481.

Using data for US manufacturing (1952-1991) the author provides an econometric analysis of the cost-reducing impact of rising stocks of high-tech equipment. A surge in returns relative to costs in the late 1970s was followed by a slump in the mid to late 1980s. 'The continued substantial investment in high-tech capital became more justifiable towards the beginning of the 1990s' (p. 471), assisted by declining prices, and relatively strong marginal products (p. 481). She also finds the savings generated by high-tech capital investment arise largely from reductions in materials inputs.

Mowery, David C. and Oxley, Joanne E. (1995), 'Inward technology transfer and competitiveness: the role of national innovation systems', *Cambridge Journal of Economics*, 19, pp. 67-93.

The economies that have benefited most from inward technology transfer, for example Japan, have national innovation systems that strengthen their 'national absorptive capacity'. This capacity relies primarily on investments in scientific and technical training, and the competitive capacity of domestic firms. Other elements such as the channels of technology transfer, strategic targeting of certain industries, trade freedom/restrictions: all these are of lesser importance (pp. 67-68).

A national innovation system includes the public agencies supporting/performing R&D, the universities (in both their research and research training functions), firms that invest in R&D and the application of new technologies, public programs intended to support technology adoption, and the laws and regulations that define intellectual property rights (p. 80). The high number of scientists and engineers has been particularly crucial in South Korea, Singapore, Hong Kong and Taiwan. Foreign study of the 'best and brightest' has played a part. Even so, an economy's system for training workers at all levels is one of the most distinctively national components of any system of innovation. National education and training systems exhibit substantial divergences and exhibit few signs of significant structural convergence [this is disputable: there have been pronounced tendencies to convergence in higher education since the mid-1980s!]. Worker mobility is lower for industry trainees than for advanced professionals: nations capture a higher proportion of the benefits in the case of industry training (p. 82).

Nevile, J.W. and Saunders, Peter (1998), 'Globalisation and the return to education in Australia', *The Economic Record*, 74, September (No. 226), pp. 279-285.

Note the Nevile and Saunders economic definition of globalisation:

> *Globalisation... can be defined as the increasing interdependence among national economies, even the integration of those economies, which is largely due to the revolution in information and communication technologies. It is most obvious in financial markets. Vast sums of money cross national boundaries each day. Transactions are made by computer, institutions all around the world are linked by computers and professionals can deal as easily in a country on the other side of the world as in their own city* (p. 279).

They cite Reich who argues that the relative incomes of symbolic analysts will increase due to their world-wide employability in a global economy, and argue that this hypothesis can be tested by examining the returns to university degrees [*but* (1) this presupposes that correlation equals causality; (2) the university graduates are not necessarily in work subject to global competition, ie. the link to globalisation is not established; (3) the correspondence between Reich's list of symbolic analysts, and university graduate occupations, is not explored].

In their human capital equation they treat the university degree as distinct from schooling, rather than considering them both part of a single quantity of years of education (p. 281). [I endorse this method, it enables the qualitative change that occurs when a new credential level is reached to be taken into account.] Earnings for males only are calculated. The results of the regression shown that between 1981-82 and 1989-90, additional returns to public-sector graduates declined slightly, a finding statistically significant at the 10 per cent level (ie. there is a nine in ten chance it did not occur by chance). Returns to private sector graduates rose from an additional 37 per cent above the earnings of someone who completed school but received no tertiary education, to 57 per cent, with the difference statistically significant at the 0.01 per cent level (ie. the finding is almost certainly not produced by chance). 'Thus, the regression analysis reaches a very strong conclusion that the return to education (in the form of a degree) increased greatly in the private sector in Australia in the 1980s' (pp. 282-283). [But note they are not comparing like with like – the earnings of a school leaver fell in relative terms over the 1980s, as retention to year 12 doubled and participation in tertiary education expanded, year 12 ceased to confer advantages in itself, ie. the denominator of the ration of degree/year 12 was shifting. Thus they measure the position relative to the person without education, but not to the workforce as a whole. The advantage of getting a degree remains. However, the notion of graduates as *increasingly* privileged relative to the whole workforce is not established.]

The authors state that the public sector outcomes can be disregarded because of the influence of non-market factors such as the Accord [they could also have mentioned the shift to a neo-liberal fiscal policy. However, note that a lot of symbolic analysts are employed in the public sector, raising question marks about the claims in relation to Reich's hypothesis]. Reich also argued that the earnings of the poorly educated would

decline because of global competition: the Australian data show a decline in earnings in real terms although it is not statistically significant (p. 283).

Offe, Claus (1997), 'Towards a new equilibrium of citizens' rights and economic resources', in Organisation for Economic Co-operation and Development, *Social cohesion and the globalising economy: what does the future hold?*, OECD, Paris, pp. 81-108.

All societies must allocate human labour power to valued, productive functions (p. 81). 'The centrality of the labour contract as the foundation of social order shows signs of erosion. Or rather, it continues to be counted upon as central, but it fails to perform its function as the cornerstone of allocation and distribution and hence (by implication) of social order' (p. 82). The growth of productivity outstrips total output so under-employment must increase. But if productivity grew slower, there would be a loss of international competitiveness (p. 83). Full employment is accordingly remote. Many jobs do not make full or even good use of the skills workers already possess (p. 94). 'Many standard forms of public and private continuing training ... often reach those already trained while bypassing those most in need of an upgrading' (p. 88). Training is a 'fuzzy technology' in terms of calculating the outcomes of investment in it, eg. job requirements shift, (p. 94). If full employment is not restored, non-employment should be made 'tolerable by controlling its consequences in terms of precariousness' (p. 93).

'Globalisation' is a term that embraces at least three distinct phenomena: (1) the economic integration of Western Europe, associated with a loss of national sovereignty; (2) the rise of East Asian economies; (3) the new proximity of Eastern Europe, with its low cost labour (pp. 86-87). [This is a very Eurocentric discussion of globalisation.]

Pappas, Nick (1998), 'Organisational innovation, structural change and the standard of living', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 157-200.

During the 1980s there was a stronger positive correlation between technological change and non-technological innovation in manufacturing, than in services. Growth in multiple factor productivity (MFP) in the non-infrastructure services provides only a small part of total MFP growth although this sector constitutes about 66 per cent of GDP (p. 160, this conclusion is amplified by regression equations p. 171). Barriers to non-technological innovation restrict growth in GDP and the standard of living. This problem provides scope for public policy intervention (p. 159). [But the problem here is surely partly at least one of measurement. For example, public sector services are recorded only as costs in the National Accounts: there is no accounting for value added, ie. in the form of externalities absorbed into other sectors.] The OECD argues that one weakness of services is insufficient organisational and institutional reform in an environment of massive technological innovation (p. 161).

Evolutionary economics interprets basic innovations as mutations that challenge and devalue not only existing technologies but also organisational routines and institutions. It takes time for firms to learn the new routines that deliver rewards in a shifted environment (p. 165). Pappas argues, following the OECD, that firms needed to develop greater know-how and skills in managing change. More advice and information should be provided in relation to quality improvement, benchmarking etc. Public policies focused on technology diffusion need to be broadened to include diffusion of strategic organisational, management and workplace practices (p. 192).

Pappas, Nick (1998), 'Changes in the demand for skilled labour in Australia', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 253-292.

Between 1976 and 1995 there was a trend increase in the mean cognitive and interactive skills of employed persons in Australia, which accelerated in the second half of the 1980s, largely as a result of change in the occupational mix of employed persons within industries (intra-industry change). It is revealed that there has also been a trend decline in the use of motor skill. This is explained jointly by the reallocation of production between industries with different mixes of skilled labour (inter-industry change), and change in the occupational mix of employed persons within industries (intra-industry change). 'The mean interactive and cognitive skill levels increased by 11 per cent and 4 per cent respectively between 1981 to 1991, while the mean motor skill declined by 8 per cent' (pp. 255, 268).

Most of the increase in use of cognitive and interactive skills is explained by intra-industry change (p. 258). The decline in motor skill is explained half by intern-industry, half by intra-industry change (p. 268). Regression analysis by Pappas finds that there are significant positive correlations between intra-industry changes in the use of skilled labour, and various indicators of technological change. 'Cognitive and interactive skill complement new technology' (p. 255). Changes in demand for skilled labour are strengthening regional inequalities. The distribution of unemployment growth favours neighbourhoods characterised by relatively high socio-economic status *and* high cognitive and interactive skill (pp. 255, 286) [but this begs the question about causality].

Motor skill includes physical strength, manual dexterity, motor coordination (p. 258). The author uses the US Dictionary of Occupational Titles to classify the broad ASCO occupations used in Australia, according to skill contents (pp. 258-260). Trends in occupation share are thus read as trends in skill requirements (pp. 261-263). [The problem here is that the occupational categories are broad, eg. 'other clerks', and there can be both great intra-occupational variation, and overall changes in occupational skill content over the time period, 1976-1995.] The shift to more highly educated, white-collar employees shows itself in the rise of the cognitive and interactive categories and the decline in the motor skills category, though there was a slight reversal of trends 1991-1995. The changes are similar to those in the USA, though the interactive and motor skill changes are greater in Australia, 'presumably due to relatively large declines in the employment shares of tradespersons and farmers in Australia' (pp. 262-263).

Most of the change in skills has been driven in the domestic consumption sector, not the export sector (p. 272). For male workers between 1986 and 1991, average earnings for interactive skill increased faster than earnings for cognitive skill, and still faster than earnings for motor skill (p. 275). [Note that interactive skills are pre-eminent for managers.] Technological change has been a major driver of changes in skills. Communications and control technology draw heavily on cognitive and interactive skills (p. 281). However, note that the impact of technological change is ambiguous:

> *Wolff (1996) argues that the notion of learning-by-doing (Arrow 1962), whereby experience in the application of a new technology in the production process leads to increased efficiencies over time, implies that technological change shifts demand toward highly skilled workers due to their ability to learn more quickly than less-skilled ones and thereby achieve greater productivity gains. Further, many new technologies perform repetitive tasks traditionally carried out by low-skilled labour. At the same time and in addition to this "up-skilling", the OECD (1996) argues that technology can also have a "deskilling" effect, in the sense that it will lower the skills required for a certain task, so that as new technologies perform a greater variety of tasks, the labour skills required to complete a job are reduced. For instance, the operator of a numerically controlled machine tool may primarily be an observer, whereas his/her predecessor may have been a craftsman. Similarly, there is some evidence that middle-management jobs, traditionally thought of as skilled, are being extinguished by the development of 'intelligent' software able to perform many information gathering tasks and analysis in addition to simple computations (OECD 1996)* (p. 278).

Firm size is negatively related to interactive skill, suggesting cultural-organisational barriers to skill upgrading (p. 281). It appears that whereas information technology is associated with a declining use of motor skills, this is less true of other technologies (p. 282): 'Overall, the employment and earnings prospects of Australian workers who do not possess a high level of cognitive or interactive skill do not appear very positive' (p. 290).

Pappas, Nick and Sheehan, Peter (1998), 'The new manufacturing: linkages between production and service activities', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 128-155.

The authors argue that while the discussion of structural change tends to assume a simple displacement of manufacturing by services, the reality is more complex.

> *Activities related to the creation, production and distribution of goods still lie at the heart of advanced economies. Many service sector firms are totally focused on providing services to manufacturing firms, or to firms producing other types of*

goods. Indeed, an integrated manufacturing-services sector – integrating the vast range of services now required to develop, produce, market and distribute industrial goods and services on a global basis – is the most dynamic sector of many economies.

The key focus should be on clusters of production and services activities, which are jointly competitive on a world scale (p. 129).

In Australia over 60 per cent of inputs to elaborately transformed manufactures (ETMs) from other industries were from the service sector. In 1995, about 35 per cent of employment in manufacturing was in service occupations (p. 130) such as accounting, scheduling, design, quality control, planning, marketing, R&D [and training] (p. 132). Hong Kong exemplifies this dual sector clustering strategy. Its prosperity is still largely driven by manufacturing although those plants are largely relocated to China. The key associated services – distribution, materials sourcing, testing, marketing, design, R&D, transport, trade finance and headquarters – remain in Hong Kong (p. 129).

Within manufacturing in Australia there has been a pronounced shift in favour of service occupations, especially highly skilled professional services. Between August 1987 and May 1995, managerial and professional staff jumped 17.3 per cent, other white collar staff increased 8.2 per cent, while there was a fall of 11.1 per cent in the number of production personnel (p. 143). The proportion of all manufacturing labour who were production personnel fell from 70.8 to 65.6 per cent (p. 144). Note that employment in para-professional occupations and sales increased particularly sharply, while plant and machine operators and tradespeople declined considerably. This led to a de-skilling of production personnel overall, for there was little change in the number of labourers (p. 144, Table 3.4). The trend to service occupations in manufacturing has occurred despite the trend to outsourcing of many activities. Together with the trend to purchase of services inputs, the occupational shift within manufacturing demonstrates the interlinking of services and manufacturing production (p. 147).

Occupational distribution of manufacturing employment, Australia, 1987-1995

	August 1987	May 1995	Percent change
	Thousands	Thousands	%
Managerial and professional	**168.6**	**197.8**	**17.3**
Managers and administrators	79.2	91.0	14.9
Professionals	64.4	72.1	12.0
Para-professionals	25.0	34.7	38.8
Other white-collar	**167.8**	**181.5**	**8.2**
Clerks	122.9	127.1	3.4
Sales and professional service	44.9	54.4	21.2
Production personnel	**815.0**	**724.4**	**- 11.1**
Tradespersons	346.5	299.4	- 13.6
Plant & machine operators and drivers	217.1	172.3	- 20.6
Labourers and related workers	251.4	252.7	0.5
All manufacturing	**1151.4**	**1103.8**	**- 4.1**

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Trends in the USA were similar but not identical. There was significant growth in the number of managers and administrators in American manufacturing 1985-95. Tradespersons declined sharply there. However, para-professionals and the whole 'other white-collar' declined sharply also, contrary to the Australian trend (p. 146).

Manufacturing still dominates R&D in Australia. In 1994-95, R&D in that sector was $1931.5 million out of $3489.4 million total R&D expenditure (pp. 149-150).

Park, Ki Seong (1997), 'A theory of on-the-job learning', *International Economic Review*, 38 (1), pp. 61-81.

The article analyses on-the-job learning in terms of the mentoring of inexperienced workers. This aspect of human capital formation is little discussed in the literature. Junior workers learn from senior workers. The worker's earnings are equal to the value of his marginal product minus tuition payments to senior workers. 'The firm exists to provide a marketplace for workers to buy and sell learning'. [In practice such tuition is often not paid and the costs are borne either by the employer defacto – through decline in the productivity of both workers during the learning process – or by both workers through the loss of earning time, in which case the larger cost in absolute terms is borne by the senior worker.] Park develops an econometric model and applies it to the Korean manufacturing industry. She finds that the earnings of an inexperienced worker in an unusually large cohort will be higher than normal.

Park, Robert, Erwin, Peter J. and Knapp, Karl (1997), 'Teams in Australia's automotive industry: characteristics and future challenges', *The International Journal of Human Resource Management*, 8 (6), pp. 780-796.

In the 1990s the Australian automotive industry has focused on developing a more flexible and team-based approach. The authors examine the results of industry reform through a study of Australia's four car makers and their largest component suppliers.

There are many different forms of work teams in the industry, from self-managed and self-directed teams (eg. Volvo and Saab), to semi-autonomous or directed teams (Toyota and the lean production systems of the Japanese industry), and traditional work groups. Off-line structures include quality circles, problem-solving teams, and project teams. The fostering of teams requires among other things 'team development training'; and reward structures that modify competition between team members, valorising collaboration instead (p. 783). Significantly, 50 per cent of the companies surveyed required self-managed work teams with 36 per cent requiring semi-autonomous 'directed' work teams; however, in the outcome, what developed was directed work teams in 61 per cent of cases, with only 17 per cent self-managed teams (p. 785). The authors suggest that lean production requires a high level of external coordination and is not really suited to self-managing teams (p. 792).

In most cases, responsibility for training was not delegated to teams. In a minority of cases it was shared between team and management (34 per cent) or managed by the

teams themselves (11 per cent). Functions more likely to be decentralised included daily production tasking, day to day quality control, job rotation, managing unplanned absences and communicating with other teams. 'Team development training' centred on problem-solving skills, 'technical multi-skilling', communication skills and Total Quality Management tools and techniques (p. 788).

At the organisational level the main benefits of the changes in production were in relation to quality, productivity and timeliness. The outcome for employee attitudes and behaviours were positive but less widespread. This outcome tends to confirm criticisms elsewhere in the literature of work teams in lean manufacturing as producing increased job pressure including team peer pressure, decreasing work satisfaction (p. 793).

Patel, Pari (1995), 'Localised production of technology for global markets', *Cambridge Journal of Economics*, 19, pp. 141-153.

Patel uses an empirical study of US patenting activity to measure the degree of globalisation of new technologies. Data on the US patenting activities of 569 firms based in 13 countries are examined. He finds that much of the literature has exaggerated the trend to globalisation of new technologies in the 1980s, eg. claims that multinationals as a whole are globalising their production of technologies. Most of the internationally located production of technology (international in relation to the parent company) is focused on the adaptation of parent technologies to specific national markets. Medium rather than high-technology industries are involved. The overwhelming majority of technology production remains close to home base and is affected by local factors including the education, training and research systems. The national context remains strong in generating comparative advantage. 'Home country conditions have a major impact on the levels and trends of the technological activities of nationally-based large firms' (p. 142).

> *The process of internationalisation of technology is influenced more by the need to adapt products for market conditions in the host country than by supply-side reasons concerned with exploiting the science and technology base of the host country* (p. 152).

Three different meanings of the globalisation of technology ('techno-globalism'): (1) the global exploitation of technology, (2) the global production of technology, (3) global technological collaboration (p. 142). There is no doubt firms are increasingly exploiting their technologies on a global scale, ie. the first form of globalisation is happening. The debate is about (2) and (3). [Thus we have globalisation of markets but not globalisation of production. NB. this is a most important point.] Re. collaboration, over 90 per cent of all agreements in the 1980s were between firms in the 'triad' countries (p. 143). Between 1979-84, and 1985-90, there was a slight rise in the proportion of US firms patenting outside the US – from 6.6 to 7.9 per cent – but practically no change in the proportion of R&D activity conducted outside the US (p. 145). Firms from all countries except Canada introduced the proportion executed outside the home country in the second half of the 1980s, but this is still small (p. 149),

with the main zone of increased international location being Europe [NB. reflects Europeanisation]. The UK firms are the most likely to patent abroad but more than half of their international patenting is accounted for by merger activity, and most of their international activity is in the US (pp. 145-150). Japanese firms are very unlikely to produce patents from outside Japan and few foreign firms develop patents in Japan. 'Only Belgian and Dutch firms executed more of their technological activities outside their home country than within' (p. 148). The most internationalised firms 'are those with their principal activities in drink and tobacco, food, building materials, other transport, pharmaceuticals, and mining and petroleum' (pp. 150-151).

> *What is of interest is that, with one exception (pharmaceuticals) these are not the 'high-tech' product groups or ones which are normally associated with having a 'world mandate' (automobiles and computers). In fact they are precisely the product groups where adaptive R&D for the purposes of serving local markets is important. Technological activities for such localised adaptation occur due to differences in consumer tastes (food, drink and tobacco), differences in government regulations (building materials and pharmaceuticals), and in order to exploit local natural resources (food, mining and petroleum). Indeed, the evidence here suggests that firms involved in the product groups with higher than average R&D intensity – computers, aircraft, instruments and electrical equipment – are below average in terms of the internationalisation of their technological activities. One reason for this could be that in these 'high tech' products, links between R&D and design, on the one hand, and production, on the other, are particularly important in the launching of major new products and benefit from geographical proximity* (p. 151).

> *The evidence presented here is also consistent with the early analyses of Vernon (1966) and Porter (1989), and the more recent literature on the 'national systems of innovation' (Lundvall 1992 and Nelson 1992), in that, far from being irrelevant, what happens in home countries is still very important in the creation of global technological advantage for firms. Thus for policy analysis it becomes important to understand the nature of the country-specific factors that have an influence in creating national technological advantage, including the competitive climate, the financial system, and education, training and basic research institutions* (p. 152).

He speculates about why 'firms involved in producing for a world market may keep most of their technology production close to home base'. Two factors related to the 'launching of major innovations' may help explain the reasons for geographic concentration: 'the involvement of inputs of knowledge and information that are essentially "person-embodied", and a high degree of uncertainty surrounding outputs. Both of these are best handled through intense and frequent personal communications and rapid decision-making, ie. through geographic concentration' (p. 152).

> *Thus it may be most efficient for firms to concentrate the core of their technological activities in the home base with international 'listening posts' and small foreign laboratories for adaptive R&D* (p. 152).

[Note the importance of trust relations in R&D/innovation/management synergies among people who share a common professional world. Contrast this with exploited workers in off-shore factories, the further away from management the better. exploitation at a distance is easier. E-mail and electronic data transfer might facilitate the growing involvement of off-shore R&D and product developer workers. This, however, would probably show up in the statistics as a home country patent, and is in any case consistent with the model of innovation core linked to small outlying stations.]

Pelloni, Alessandra (1997), 'Public financing of education and research in a model of endogenous growth', *Labour*, 11 (3), pp. 517-539.

Pelloni proposes a two factor endogenous growth model in which the government intervenes in the economy by financing research and/or education, and technology in public production may vary from that in private production. The implications for taxation policy are traced: it is argued that Pareto optimality can be achieved by means of a consumption tax in a decentralised setting, but not by means of income tax (p. 517). Education is modelled as a public not private concern, 'which is generally consistent with the facts'. Knowledge is best fostered by treating it as a public good with a competitive price of zero. (p. 518). The position is further explained in footnotes. Public goods are nonrivalrous and nonexcludable:

> *An input in a production process can be defined as nonrivalrous if its use in one activity does not reduce the amount available for other activities. A good is nonexcludable if people cannot be prevented from using it. Both basic science and applied science are nonrivalrous: Pythagoras' theorem as well as a metallurgical formula or a chip design, once discovered, can be used at zero marginal cost by anyone. In an economy in which technical ideas are commodities, the basic premises of classical welfare economics are violated and the optimality of the competitive mechanisms is not assured* (p. 536).

[She notes that this has been further explored in P. Romer (1989), 'Capital accumulation in the theory of long-run growth', in R. Barro (ed.), *Modern business cycle theory*, Harvard University Press, Cambridge, MA; P. Romer (1990), 'Endogenous technical change', *Journal of Political Economy*, 98 (5), Part II, pp. S71-S102; P. Romer (1990), 'Are non convexities important for understanding growth', *American Economic Review*, 80 (2), pp. 97-103.]

> *From a prescriptive point of view, even if human capital as embodied knowledge is rival and excludable, the important externalities it generates can be invoked in favour of its public accumulation. Also equity considerations for public education seem particularly important in the light of the results of endogenous growth models. In fact one implication of such models is that, ceteris paribus, the initial distribution in human and nonhuman wealth tends to perpetuate itself, being transmitted down from parents to children, leading to persistent income inequality,*

even if models in which the utility of children enters the utility function of parents. As is well known, other grounds for public education arise in a stochastic context: the incompleteness of capital markets makes it impossible to share the risk of human capital accumulation and the imperfection of credit markets makes it impossible to borrow to pay for it (p. 537).

Pischke, Jorn-Steffen (1996), 'Continuous training in Germany, *National Bureau of Economic Research Working Paper* No. 5829, NBER, Massachusetts, MA.

The paper uses data from the German Socio-Economic Panel 1 to describe the incidence, attributes and outcomes of continuous training received by workers in Germany between 1986 and 1989. Training is primarily a white-collar phenomenon and is concentrated among the more highly educated, and in the service sector and in public administration. Much of the training appears to be general and provided to workers by their employers at no direct cost. Training does not appear to result in large short-run wage gains, especially for men.

Much attention is focused on the German system of apprenticeships and vocational schools. But when German workers were surveyed in 1979 on where they acquired the skill used most in their job, the two most important avenues of acquiring job skills were formal firm-based continuous training, and informal training on-the-job by colleagues or by learning-by-doing (p. 1). 'Continuous training' here means 'any form of skill enhancement that takes place after a worker has acquired an initial occupational qualification'. It can mean improvement of existing skills, or learning a new occupation or trade. It is hard to get a good empirical description of continuous training because of the prevalence of 'informal channels'. This paper focuses on the more formal aspects of continuous training, mostly as course or seminars (p. 2). Similar patterns to those observed in Germany are observed in studies conducted in the US (pp. 9-10).

In fact, 70 per cent of respondents interested in continuous training mention the need to keep abreast with new developments in their own occupation and to adapt to changes in the way work is done. The more skilled the respondent, and the more responsible the job, the more likely this reason is mentioned. But even 40 per cent of those in unskilled blue-collar positions see the need for training so as to adapt to change. In addition, 62 per cent of skilled blue-collar workers and 88 per cent of managers and professionals mentioned this reason. Other important reasons are additional qualifications for promotion, reviewing vocational knowledge for the current job, and learning about new areas. Retraining for a new job or gaining an educational qualification are less important reasons, mostly named by respondents without previous qualifications (pp. 4-5).

Attitudes to participation in continuous training by job position, Germany 1989

Job position	Of those employees interested in training, the proportion who named these factors as reasons why they might participate in training (those interested in training constitute 66% of total sample, ie. this n= 2762):						Proportion of sample interested in training (n=4763)
	adapt to changes	qualify for promotion	refresh old skills	learn new areas	learn new occupation	obtain degree	
	%	%	%	%	%	%	%
Unskilled bluecollar	40	46	27	39	47	26	29
Semi-skilled bluecollar	44	42	32	35	29	9	37
Skilled bluecollar	62	57	39	38	14	4	60
Foremen	75	53	43	27	3	5	66
Self-employed	74	24	53	36	6	4	57
Simple whitecollar	61	46	40	41	22	11	64
Skilled whitecollar	76	57	51	42	11	4	83
Manager/professional	88	57	57	48	2	3	86
Public sector low rank	69	60	58	38	19	6	83
Public sector middle	83	56	56	31	3	4	87
Public sector upper	76	33	77	36	6	4	92
Total	71	50	49	40	13	6	66

'Continuous training is not evenly spread throughout the economy but rather is concentrated among few workers' (p. 9). Training incidence rises with schooling, occupational position, white-collar or public servant status, firm size. Training is more prevalent in larger firms. Training is concentrated among the younger. 'Women tend to receive less training, even after controlling for education, occupation, industry and part-time status' (p. 8). There is more continuous training among white-collar and public sector workers rather than blue-collar workers. In the last group it is highest among qualified skilled workers, foremen and supervisors. 'Basically no continuous training is received by those with few initial skills'. This suggests training is unlikely to be an equalising force but rather exacerbates pre-existing differences in skill (p. 9). The low level of training among the unskilled might reflect the higher turnover and therefore more new job spells in these positions (p. 11).

The main obstacles to individuals being involved in training include the direct costs or lost earnings involved, time constraints, and the fact they do not see additional training being useful in their job. 'Interestingly, time constraints are mentioned more often by blue-collar workers than by professionals (p. 5). The highest incidence of time constraints is among the self-employed (Table 1). Most who participated in training did so in more than one course (70 per cent). Multiple courses were most prevalent among managers and professionals. The employer bears at least some costs (training in working hours, fees etc.) in 80 per cent of the training of those in employment (p. 6). The service sector has a good deal of training but also diversity. Government, non-profit organisations and the educational and insurance sectors train the most, miscellaneous service industries the least (p. 8).

Most training is initiated by workers. In a quarter of cases it is solely initiated by employers. In 20 per cent the initiative is shared by workers and employers (p. 12). Employers are the main source of financial assistance. Their support is roughly even across the occupational groups (p. 12). In fact, 70 per cent of respondents report that they acquired additional skills through training and 80 per cent altogether said it was successful in some way (pp. 12-13). Training during working hours seems more successful than training outside those hours (p. 14). There are small wage gains for men

from training, which may explain the reluctance to go into after hours training (p. 21). A large part of the skills received are portable to other employers (p. 22). Returns for training are much higher for women than men. The returns are highly non-linear in relation to duration of training. These last two findings need further investigation and explanation (p. 22).

Pistorius, C.W.I. and Utterback, J.M. (1997), 'Multi-mode interaction among technologies', *Research Policy*, 26, pp. 67-84.

The interaction between technologies is typically understood in terms of competition, implying confrontation and attack/defence. Pistorius and Utterback argue that 'the interaction between technologies should be viewed in a broader sense than mere competition' and that a 'multi-mode' framework can provide for more than one kind of interaction. The concept is taken from biological and organisational ecology. For example the effects of one technology on another's growth rate can take the form of symbiosis, and the form of predator-prey, as well as pure competition [implying displacement]. An emerging technology can have a positive or negative influence on the growth of a mature technology, and a mature technology can have a positive or negative influence on the growth of an emerging technology. This suggests four possible combinations:

- Competition, where each technology has negative effects on the growth of the other;
- Symbiosis, where each have a positive influence on the growth of the other;
- Predator-prey, where an emerging technology has a positive influence on the growth of a mature technology and the mature technology has a negative influence on the growth of the emerging technology [type A], or the emerging technology has a negative influence on the mature technology but the mature technology has a positive influence on the growth of the emerging technology [type B] (p. 72).

The interaction between technologies might temporarily shift from one mode to another. This suggests it is necessary to develop managerial strategies applying to all three modes of interaction, not just competition. Strategies based purely on a competitive relationship between technologies can be highly counter-productive in other settings (p. 69). [It might be more fruitful to understand the emergence of new instructional and communications technologies in education not as a case of competition/displacement, but as one of symbiosis, or perhaps in some circumstances type B. Note here that the shift between modes is not necessarily evolutionary, it can be constructed as a consequence of deliberate policies and organisational structuring.]

Poh, Gan Khuan (1996), 'Human capital formation: public policy approach', *The Singapore Economic Review*, 40 (2), pp. 159-183.

Poh finds that the high performance Asian economies achieved spectacular economic growth 'primarily on the strength and ingenuity of their human resources as illustrated by the change in total factor productivity (TFP)'. Technological development 'is the key variable in determining the long-term growth and prosperity of an economy' and human capital growth feeds into productivity growth (p. 161). [The many problems and ambiguities that lie in attempting to secure these education–productivity–growth relationships are not explored.] Public policy is instrumental in the accumulation of both physical and human capital, and is also an important component in continuous opportunities for skill upgrading and the acquisition of new skills in accordance with structural economic transformations. Globalisation and the attendant increase in international competitiveness suggest that human capital development will be more important in future (p. 159).

In the early stages of industrialisation the East Asian countries focused on primary and secondary schooling – 'teaching the basics to all children' – rather than university education as in Latin America and India. This increased base-level productivity on a broad basis and promoted income equality [it is not clear how so], consumer-spending power and a social consensus on economic development policies (pp. 163-164). Adult literacy grew fairly slowly to 60 per cent by 1975 and then more rapidly to 91 per cent in 1994 (p. 169). By 1990, 93 per cent of 6-7 year olds were enrolled in first grade and of the enrollees at first grade 96 per cent completed six years of primary school (p. 170).

In the years 1992-1994 more than 20 per cent of all Federal government expenditures were allocated to education, and in 1992 and 1993 educational expenditure constituted 5.9 per cent of the gross national product (GNP). The highest level reached from 1965 to 1994 was 7.6 per cent in 1986. However, per capita spending has risen by two thirds since then (p. 168). As the economy develops and high skill professional and technical labour becomes increasingly important, a shift to higher qualified graduates is needed (pp. 163-164). In the second half of the 1980s the Malaysian economy experienced significant skill shortages in manufacturing. The government has focused on increasing the supply of graduates – enrolment in tertiary education was 7 per cent in 1992 compared to 4 per cent in 1980. In the 1996 Budget it was announced that all institutions of higher education would introduce distance education. Government Corporations such as Telekom Malaysia provide their own training institutes or help support new colleges in technical and technology fields. The Ministry of Education runs 70 vocational schools, nine technical schools and seven polytechnics providing vocational education. The government is also encouraging greater private sector involvement. The largest enrolment is at Diploma level, with emphasis on computing and business education. There were 55,111 enrolments in private tertiary institutions in 1991 (pp. 175-178). However the Government's role in education and training continues to be crucial, to remove or correct market distortions and ensure the right mix of skills to meet needs.

> *This role cannot be left entirely to the private sector because the long-term objectives of human resource development to match the demand and supply of*

labour involves longer-term planning and large financial resources which only the government is capable of mobilising. Firms will be more interested in short-term gains and some bigger firms may undertake broad-based training as a defensive strategy by acquiring innovative firms. Firms will also have no incentive to innovate if there is no guarantee of windfall gains from it and therefore may prefer to be followers rather than engage in expensive innovative research. On the other hand, human capital formation cannot be left entirely to the Government alone. It will be too costly and somewhat impossible to meet the specific skill requirements of every industry. The cost of mismatch will also undermine efficiency. Hence, a blend of government and private sector involvement and collaboration is essential for sustained human capital formation (pp. 180-181).

Transnational companies operating in Malaysia are required to provide training as part of their operating conditions, and there is also an on-going transfer from them of technical, production/organisational and managerial knowledge (pp. 175-179). Examples are provided of education/private sector collaboration and broad-based approaches to training (pp. 179-180). Foreign training institutions and universities have contributed significantly to human capital formation in Malaysia; however, there has been a 'brain-drain' to the countries of foreign providers. This can be ameliorated by improving living standards and opportunities in Malaysia, and systematic networking so that overseas students are aware of home country job opportunities (p. 180).

Preston, Alison (1997), 'Where are we now with human capital theory in Australia?', *The Economic Record*, 73, No. 220, March, pp. 51-78.

Preston reviews Australian debate about the status of human capital theory. She asserts the continuing relevance of the theory to the contemporary Australian economy, stating that it enables meaningful predictions even in circumstances where wages are determined in part by non-competitive factors. She applies that theory to calculations of the returns to work in 1981 and 1991: and variations according to demographic characteristics, sector of employment, geographical location, industry, occupation and gender. The lack of data on time for training on-the-job is a difficulty (p. 53).

Overall, Preston finds that for 1991, 'the basic human capital model is capable of accounting for 38 per cent of the variation in wages across individuals'. Males residing in metropolitan areas had an earnings advantage of 8.3 per cent. Males employed in the private sector earned 6 per cent more than their private sector counterparts. Two thirds of the gap can be explained by differences in human capital characteristics. The 'raw' gender gap is 19.9 per cent of which 27 per cent can be explained by differences in the measured characteristics of men and women. The 'adjusted gender gap is therefore 14.5 per cent, meaning that women earn 85.5 per cent of the wages of their male counterparts' (p. 72). Changes in the occupational distribution of males and females over the period 1981-1991 'appear to have widened the gender gap by 8 per cent' (p. 71). Preston concludes that the weakness of human capital theory is its inability to explain significant and persistent inter-industry, inter-occupational and gender wage differences (p. 73).

Quiggin, John (1994), *The human capital orthodoxy defended*, paper prepared while working at the Centre for Economic Policy Research, Australian National University, Canberra.

The paper polemicises in favour of 1960s human capital theory (that is, high public investment human capital theory) and against the screening theory and public choice theory views of education. He argues that the latter two perspectives have come into more favour because they provide ready grounds for cutting public expenditure (p. 38) – screening theory implies that education is a cost (the cost of its screening function) rather than a benefit, while public choice theory argues that more expenditure does not necessarily lead to improved student outcomes, and cutbacks have no necessary negative implications for quality. However, he states, these theories have no solid empirical grounding. In contrast human capital theory, which has been the subject of a huge body of empirical work, is readily defended on empirical grounds. Education has persistently been shown to be a high-return investment (p. 1). [However, he fails to distinguish between high public investment human capital theory and the contemporary market liberal private investment variant now in vogue, and thus fails to explain why the former should be preferred to the latter.]

The paper summarises 1960s human capital theory, noting that it can be extended to forms of education that do not lead to higher earnings. It is difficult to separate the consumption and investment aspects of education (p. 8). His summary of screening theory – the postulate that the basic economic function of education is to act as a screening device to facilitate employer selection of potentially high productivity employees, ie. success in education does not signify that the necessary attributes already exist, rather the necessary learning takes place on the job and success in education operates as a proxy for employability - is less complete. He [rightly] suggests that it is difficult to postulate screening theory in the form of testable hypotheses (p. 13). The Institute of Public Affairs' (IPA) 1990 interpretation of public choice theory is convincingly demolished, on logical, empirical and policy grounds. Noting the IPA assumption that 'unless there is evidence to the contrary, high staffing ratios do not provide a better quality of service', Quiggin comments that:

> *Obviously, the IPA assumption cannot be true for all possible staffing ratios or it would imply that one teacher could satisfactorily teach a thousand students. So there must be some 'cut-off' ratio beyond which the IPA assumption does not apply. In practice, the IPA implicitly defines the cut-off ratio as the lowest staff-student ratio prevailing anywhere in Australia, and argues for 'levelling-down' to this minimum ratio. But no basis at all is presented for choosing this level rather than a higher or a lower one* (p. 6).

He reviews the empirical evidence for the human capital approach, noting some of the research difficulties; the separation of the effects of ability and education, the quarantining of the value of investment in education from the effects of fluctuations in the labour markets, the problem of measuring school and teacher quality, etc. (pp. 9-12). He reviews screening theory in empirical terms, though there are few relevant studies. [He postulates the problem as either/or, that is, we can have a human capital effect *or* a

screening effect but not both together (pp. 13-16).] He also reviews the empirical evidence in relation to public choice theory. Quiggin points to the real world associations between resources and outcomes (pp. 16-17). He also reviews the production function literature, focusing on Hanushek whom he accuses of downplaying both the difficulty of education production functions, and 'the positive evidence that increases in aggregate expenditure per pupil contribute positively to measured outcomes' (p. 19). He extends earlier arguments to a rejection of Blaug's adherence to screening theory and to a point by point critique of Maglen's screening theory-influenced critique of human capital theory. Maglen, states Quiggin, subjects human capital theory to a close critique but fails to exercise the same rigour in relation to screening theory (p. 23). He looks at growth accounting, where both Denison's (1962) theorisation, and endogenous growth theory, are drawn in to advance the argument for a human capital world view. The IPA arguments are subject to more detailed refutation (pp. 28-32). He concludes that education cutbacks have been carried out without specificity or sensitivity, and that public investment should be increased.

Quiggin, John (1994), 'Approaches to measuring efficiency and effectiveness in schools education', paper presented at a conference on 'Public investment in schools education: costs and outcomes', sponsored by the Schools Council and the Centre for Economic Policy Research, Australian National University, Canberra, March.

In addition to the arguments outlined in the above paper, Quiggin focuses on what he identifies as potential output measures of human capital: school retention rates, measures of satisfactory course completion, the number of students going on to further education, the labour market performance of young people. Increases and improvements in these measures suggest that school system output has 'increased substantially over the past twenty years'. However output measures need improvement. One is the heterogeneity of State/Territory examinations and qualifications. Output measures must be sensitive to questions of quality of education, and the character of educational outcomes. Comparisons between schools and between systems must be handled with care because many factors contaminate like-by-like comparability (pp. 33-43).

Roche, William K., Fynes, Brian and Morrissey, Terri (1996), 'Working time and employment: a review of international evidence', *International Labour Review*, 135 (2), pp. 129-157.

The article tests the potential of the policy objective of work sharing in the context of unemployment. It reviews the recent experience of working time standards and working hours in the OECD countries, overtime, job sharing, and 'job trading' (early retirement, extended leave). The authors conclude that in relation to reductions in standard working hours, the recent experience has been 'disappointing' and there might even have been movement in a negative direction. Job-sharing remains a very small scale activity.

Sako, Mari (1996), 'Suppliers associations in the Japanese automobile industry: collective action for technology diffusion', *Cambridge Journal of Economics*, 20, pp. 651-671.

The article discusses aspects of the operation of suppliers associations in the Japanese automobile industry. Groups of independent suppliers are attached to each of the major assembler-manufacturers except for Honda. Supplier relations are more than an intersecting grid of bilateral relations between manufacturer and supplier. Suppliers constitute a 'network of innovators'. Sako argues that inter-supplier coordination in technology diffusion is an important factor in the competitiveness of the industry. Supplier networks are as important as the supplier-assembler relationship which has received much more analytical attention. Lateral communication and learning between suppliers is highly valued. There is overlap between the different associations, and some major suppliers serve several assembler companies. These major suppliers – rather than the assembler manufacturing firms – are the 'nodes' of the industry network. There is much informal exchange. These are significant and under-recognised externalities associated with the bilateral supplier-assembler contracts (pp. 669-670).

Sels, Luc (1997), '"Timeless craftsmanship"? New production concepts in the machine tool industry', *Work, Employment and Society*, 11 (4), pp. 663-684.

Sels' article analyses the results of the Belgian trend study, which examined the prevalence of new production concepts in the automotive, machine tool, chemical and clothing industries. The normative framework for the study is that of deconcentration linked to job integration. In this approach supporting and preparatory staff services – planning, programming, quality control, maintenance, quality assurance, personnel etc, - are integrated into the production departments, staff services are trimmed and staff and production departments are merged and staff services are assigned to line management. In contrast, a Taylorist approach removes the 'indirect' tasks from production jobs, creating 'segregated' production jobs rather than 'integrated' ones (p. 665).

He notes that there are three ways of organising production. In an 'operation-oriented' structure identical operations are grouped into production divisions. The sequencing of different operations is relatively open. There is flexible linking, but high inventories, long routing times and reduced productivity. In a 'flow-oriented structure' there is a fixed and sequential order – higher productivity, but limited product mix and volume flexibility. In a 'product-oriented' structure, one product is largely finished in a clearly demarcated processing phase. Each production division makes one type of product. The link between processing steps is clear. The process moves in one direction but takes multiple routes. This approach is meant to be the most suitable for minimising coordination problems in an unstable environment. Conversion from a line-oriented to a product-oriented approach is meant to lead to an increase in flexibility, with productivity held constant. The product-oriented approach also lends itself to broad jobs which group together a wider range of tasks (p. 666).

In car assembly change is readily observed. The old production departments have been broken down into separated processes handled by partly self-sustaining teams. However deconcentration has not been extended to such processes as maintenance, quality control and personnel policy which have therefore not been integrated with the work groups. Work has been intensified. In the chemical industry the trend to partial deconcentration is absent. The old departments and plant hierarchies persist. In clothing there is greater competition, calling up quick responsiveness, but little change in the division of labour can be detected. In all three areas the fundamentals of the Taylorist production system have not been challenged. This is 'neo-Taylorism' not 'post-Taylorism' (pp. 678-679). The machine tool industry is different. Forms of production organisation have moved consistently towards deconcentrated support and preparation of production. Metal cutting and shaping work in a very different manner to assembly – low versus high automation, product-oriented versus operation oriented – but the two spheres, each integrated on their own terms, are effectively coupled. However, it is only the more routine programming tasks which are fully integrated into operator jobs. Large companies have mostly not chosen full integration, preferring 'a model of flexible cooperation between the operators and the programming office' (p. 680).

Sen, Amartya (1997), 'Editorial: human capital and human capability', *World Development*, 25 (12), pp. 1959-1961.

Sen argues that the formation of human capital should be understood in the broader framework of the expansion of human capability for the purposes of the enrichment of life, enabling human beings 'to lead lives they have reason to value and to enhance the substantive choices they have'. From the point of view of the individual, the expansion of human capital has indirect benefits, but the enhancement of human capability has direct benefits. 'This is because human beings are not merely means of production (even though they excel in that capacity), but also the end of the exercise' (p. 1960). Capability expansion also helps bring about social change, which extends beyond economic change.

> *If education makes a person more efficient in commodity production, then this is clearly an enhancement of human capital. This can add to the value of production in the economy and also to the income of the person who has been educated. But even with the same level of income, a person may benefit from education, in reading, communicating, arguing, in being able to choose in a more informed way, in being taken more seriously by others, and so on. The benefits of education, thus, exceed its role as human capital in commodity production. The broader human-capability perspective would record - and value - these additional roles. The two perspectives are, thus, closely related but distinct* (p. 1959).

Sen cites Adam Smith, noting Smith's commitment to education and 'his massive confidence in the improvability of human capabilities' (p. 1959). Smith links the expansion of productive abilities to the ability to lead different types of lives. The concept of human capital, 'which concentrates on only one part of the picture (an

important part, relating to broadening the account of "resources")' is 'enriching' but needs 'supplementation' (p. 1960).

Sheehan, Peter and Tikhomirova, Galina (1998), 'The rise of the global knowledge economy', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 27-85.

The authors argue that the revolution in information technology and communications, together with deregulation, are driving the emergence of the global knowledge economy. Its defining characteristics are 'knowledge intensity and globalisation' (pp. 29-30).

'The central technological fact' of the global knowledge economy [the term is derived from the OECD] is 'the ability to deliver codified knowledge ... very quickly and cheaply to the area where it is needed, to transform such knowledge extensively as required' and to use it in machines etc. (p. 37). The race is on to produce transistors so small they are at the known physical limits, which are 300-400 atoms wide. Between 1975 and 1995 the price/performance ratio of computing fell by 10,000. The transmission of information by light messages through optic fibre cables offers almost unlimited capacity in terms of numbers of lines, and bandwidth available to those lines. In digital mode all forms of communication (voice, data, video etc.) are essentially the same and this contributes to the current emphasis on open systems and maximises interoperability and interconnectivity in information technology systems, requiring the development of common international standards and protocols. There have also been parallel advances in technologies related to the capture, storage and use of information such as scanning, imaging, display monitors, copying etc. Complementing the development of computing and communications hardware there has been a major development of software (pp. 30-32).

The Internet achieved full functionality with the development of the software and networking protocols that define the World Wide Web (Berners-Lee at CERN in Switzerland, 1989-91) and the Mosaic browser (Andressen etc. at University of Illinois 1993) and its commercial release by Netscape in 1995. There were 159,000 Internet hosts in 1989, 1.776 million in July 1993, and 29.670 million in January 1998 implying total users of 50-60 milllion. It is expected that by 2000 there will be 500-600 million people using the Internet, 10 per cent of the world's population (pp. 32-34).

In economic terms the central feature of the information technology revolution is 'the ability to manipulate, store and transmit very large quantities of information at ... almost zero marginal cost for many users'. Also the pervasiveness of these technologies, which reach into every aspect of the economy. They facilitate the application of knowledge to all elements of the economy, globalisation, new industries, and changes to world labour markets. The ultimate impact of the technological changes depends on 'the economic and social context' which is greatly affected by deregulation. This includes reductions in trade barriers, the freeing up of capital markets, easier technology transfer, and the deregulation of internal markets in goods, services and finance (pp. 34-35). In 1980 the ratio of foreign exchange trading to world trade was

about 10-1, in 1995 daily trading was US$1260 billion, a 70-1 ratio. There has also been massive growth in the international bond and equity markets, and the markets for derivatives such as currency and interest rate futures, swaps and options. The deregulation of telecommunications, including induced competition and privatisation, is another example (pp. 36-37).

Knowledge is incorporated into productive activity in many ways, including training. One method of measuring the increase in 'knowledge intensity' is to measure the level of expenditure on R&D per unit of production. This ratio increased substantially in almost all industries during the 1980s (pp. 38-39) [but the measurement of separate and specialist R&D as a proxy for knowledge in general appears to work against the logic of knowledge as 'embodied' into an increasing range of activities]. Another indicator is the increased importance of high knowledge intensity industries relative to low knowledge intensity industries (p. 39). In the first half of the 1990s there was massive growth in high technology exports of 11.9 per cent per annum compared to 5.8 per cent per annum growth in all manufacturing exports (p. 41). The growth of high technology imports is accompanied by a dramatic fall in the unit cost of many of these commodities, suggesting a much greater growth in the role of the products themselves. 'It does seem likely that high tech exports will in due course become the dominating element in world goods trade' (p. 42). Note that between 1970 and 1995 the share of world exports of computing and electronic products held by the ASEAN countries plus East Asia (Korea, Taiwan, Hong Kong and China) rose from 3.4 to 36.6 per cent (p. 44).

However the US is the clear world leader in the knowledge intensity of production, as measured by the knowledge intensity of manufacturing (p. 45). In the US wages have grown more rapidly in the knowledge intensive industries since the early 1980s, but the knowledge composition of both manufacturing wages – and particularly of manufacturing employment – have fallen since 1986 (pp. 47-48). [This reflects of technological displacement of labour within the R&D intensive industries.]

In the OECD region in 1985-1994, trade in services grew faster than manufacturing trade. 'Other private services' – excludes travel, transportation and 'official services' and includes fast growing areas such as computer and data processing services, data base and other information services, etc. – grew at 12.8 per cent per annum, and was the fastest growing area of trade in the OECD, reaching 10.4 per cent of merchandise exports in 1994 (p. 49). In Singapore exports of other private services reached $16 billion in 1995 and grew 23.6 per cent per annum 1985-1995 (p. 50). In Australia during 1985-1995 other private services grew 13.8 per cent per annum compared to an overall 8.9 per cent growth in merchandise trade (p. 51). Growth of other private services was even more rapid in Germany, Japan and the Netherlands. Note that Australian total services exports grew more rapidly than in any of the leading OECD countries. In Australia 'person and knowledge-based services' is a larger component of GDP than goods industries, the same as in the USA but unlike Germany and Japan. In Australia the third category of GDP, goods related services is a rising component also (pp. 70-72).

Globalisation as the authors define it, following Hatzichronoglou, incorporates foreign direct investment, capital transfers other than direct investment, trade flows of goods and of services, and technology transfers (p. 53) [ie. it is a catch-all for cross-border economic contact involving financial exchange]. One aspect of globalisation is

the growing inter-relationships between trade, finance and technology flows. Other features include: 'simultaneous competition in each market between numerous new competitors from all countries, an increased intra-industry component of trade, 'diminished importance of trade which is no longer virtually the sole vector of globalisation', emergence of specific regional and cultural factors, 'national comparative advantages increasingly correspond to advantages of location which vary according to corporate strategies' (p. 56). Globalisation is associated with massive foreign direct investment into the USA as well as from the USA to the rest of the world (p. 62). It is also associated with the more general trend to trade in services. 'The internationalisation of services will likely lead the next stage of economic globalisation' (World Bank). Technology makes possible delivery of many services at a distance. Key factors in determining competitive position in services will be cost and service quality, integration into existing cultural patterns eg. in health and education, and technological leadership (pp. 66-67).

Sheehan, Peter and Tikhomirova, Galina (1998), 'The nation in the global knowledge economy', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 87-125.

National competitiveness is not reducible simply to international trade position. It is 'a matter of the ability of the nation's economic system to sustain a high and growing life for its citizens while being open to global competition' (p. 90). There is increasing evidence that the nations of the world are polarising rather than converging in economic terms, which conflicts with standard neo-classical theory and the IMF's predictions (p. 92). Data illustrating this follow. The crash of 1998 has devastated East and South-East Asia, with only Taiwan and China exempt (p. 97). In Russia the 1997 GDP level was 39.3 per cent below that of 1991. In the Transcaucacus and Central Asia the decline was 36.2 per cent, in Central and Eastern Europe 18.8 per cent (p. 98). The long post-war process of convergence of the developed countries towards US income levels also seems to have ended (p. 99). Japan's superiority in technology-based manufacturing in the 1980s gave way to US superiority in knowledge-based services in the 1990s (p. 89).

Australia's strengths are its strong knowledge base relative to population, the rapid uptake of new technologies and being in a strong position to embrace the online economy ('a good telecommunications infrastructure and a skilled software industry', eighth highest PC penetration in the world with 240/1000 in 1995). Other strengths include a range of competitive industries (agriculture and mining, parts of manufacturing, services), the fact that substantial adjustment has occurred, having a relatively open society, and location in the Asia-Pacific region. *But* rapid adjustment has been at the expense of creating a competitive firm and industry structure. 'The nation has little productive capacity in large areas of industrial activity'. Many Australian firms are very small relative to the scale necessary to achieve international competitiveness. Many multinationals operating in Australia are focused on the Australian market rather than on R&D and product development in relation to global markets. Australia has failed to attract its share of the foreign direct investment, especially for the creation of

new productive capacity rather than asset purchase (pp. 101-103). 'Australia has failed to capture any share of the upsurge in global foreign investment since the mid 1980s' (p. 117).

> *The processes of adjustment in firms and government agencies have largely been through external means (retrenchment, contracting out, downsizing, use of temporary employees, privatisation and sales of businesses) with less attention having been given to the retraining and redevelopment of capabilities within the firm* (p. 102).

As a result of these factors 'a viable competitive industry structure consistent with rapid growth and a return to full employment is not yet in place' (p. 102). There is limited experience in effective policies to address the problem of firm/industry structure (p. 104). In 1994-95, 93 per cent of Australian firms had less than 20 people. Only 27,000 had 20 or more. Productivity increases sharply with size, especially in manufacturing: gross product per head in firms with more than 100 people is more than double that for firms with 5-19 people. This firm size distribution resembles Spain rather than Germany or the USA (p. 105). Only about 2.5 per cent of firms with less than 20 employees exported at all in 1994-95 (p. 107). Yet in Australia the large firms are poor exporters. And among manufacturing firms undertaking R&D the level of R&D and innovation spending as a share of sales is five times higher for firms of less than 10 employees, than for firms with 500 or more employees (pp. 107-108). This is partly because 46.7 per cent of firms with 500 or more employees are at least partly foreign owned and almost 30 per cent of these are at least half foreign owned (p. 108). 'The foreign share of sales is particularly pronounced in higher technology industries – being 56.0 per cent in the high R&D intensity category and 61.4 per cent in the medium high category' (p. 109). The foreign firms dominate and have poor performers, those Australian companies that are in the high tech sector are smaller but often going very well (p. 111). The authors draw the conclusions that (a) it is vital to develop better R&D and export performance by foreign firms operating in Australia; and (b) it is important to foster small, high export and relatively high R&D Australian companies in the high tech sector (p. 110). They also note the problematic character of the medium high tech industries, eg. Motor vehicles and chemicals, which are low R&D and export performers and two thirds of the sales of which are controlled by foreign firms (p. 111).

On the positive side, the overall balance of trade on goods and services has moved from a deficit of 4 per cent of GDP in 1982-83 to a small surplus in 1996-97 (p. 122). One area of progress is the growth in services exports. Between 1987-88 and 1997-98 services exports rose by 9.7 per cent p.a. while services imports rose by 7.6 per cent p.a. (p. 122). Another area of progress is the 14.2 per cent p.a. growth in exports of elaborately transformed manufactures (ETMs), over the same time period, in current prices. This rate of growth was 14.8 per cent p.a. in constant prices. It compares to overall growth of 7.8 per cent p.a. in exports and 8.1 per cent - and 8.7 per cent in imports of ETMs – in current prices (pp. 120-121). Nevertheless, Australian imports are more aligned to high tech industry, than are exports (p. 113). At $65.6 billion in 1997-98, imports of ETMs still exceeded exports of $16.6 billion by a factor of three (p. 121).

A national debt level of $200 billion or 40 per cent of GDP (1997) is also a constraint on policy makers, though the level of debt appears to have stabilised (p. 119).

Snower, Dennis J. (1997), 'Challenges to social cohesion and approaches to policy reform', in Organisation for Economic Co-operation and Development, *Social cohesion and the globalising economy: what does the future hold?*, OECD, Paris, pp. 39-60.

Policy systems are making OECD countries 'increasingly vulnerable to economic, social and political shocks' by retarding market activity and responsiveness (p. 39). The greater the number of people needing support, the greater the pressures on governments to reduce that support. 'The prevailing systems ... are a bit like quicksand: they start giving away as soon as enough weight is placed on them' (p. 42). He proposes replacing the tax-transfer system with a system of compulsory private savings which can be withdrawn to cover unemployment, education, old age pensions, etc. The government would top up the contributions of people in the 'lowest' income groups. If the savings were at zero, the individual would receive welfare support as at present, financed by employed people (p. 51). The retirement age should be raised (p. 56).

There is an 'organisational revolution', little discussed in economics but documented extensively in the business management and sociological literatures. Its components are (1) flatter structures based on a large number of work teams reporting top central management, eliminating middle managers; (2) multi-task roles for the small teams, rather than separate specialist units, enabling better focus on customer needs; (3) a drastic reduction in returns to scale with the introduction of flexible machine tools and programmable equipment and computer-based customisation of product, all enabling 'smaller batch sizes, shorter production cycles, smaller delivery lags, and ... quicker product development', hence 'lean production' with low inventories, 'just-in-time production', etc.; (4) companies provide a broader range of products and better quality control, enabling more customer-friendly marketing; (5) increasingly, employees are being given multiple responsibilities for production, development, finance, training, customer relations, etc., breaking down old occupational barriers (pp. 45-46).

> *The new, smaller, customer-oriented teams require versatility and cognitive and social competence, as well as judgement. What matters is not simply the competence in a particular activity of production, organisation, development and marketing, but rather all-round knowledge, the potential to acquire multiple skills, and the ability to learn how the experience gained from one skill enhances another skill* (p. 46).

Stanworth, Celia (1998), 'Telework and the information age', *New Technology, Work and Employment*, 13 (1), pp. 51-62.

Stanworth provides a critical assessment of the 'information age' and 'knowledge society' literature premised on the notion that information and communications technologies constitute a new heartland technology with potential for a new wave of economic development, faster rates of innovation and the reworking of all social relations. This work intersects with the 'post-industrial' and 'post-Fordist' literatures. Though the last is focused on changes in manufacturing rather than services, 'most of the writings, as with flexible specialisation, forsee an optimistic future where technology-based revitalised economies operate with reskilled collaborative workers'. There is also an element of post-modernism in the emphasis on global relations, empowered and discerning customers constantly demanding new goods and services [and in the emphases on diversity, difference and self-regulation]. 'It also tends to be technologically deterministic, with the assumption that technology is an irresistible driver for progressive change'. It is forecast that if there is a slow take-up of the technology the consequences will be economic deterioration, [loss of competitiveness], and growing unemployment (p. 51). [In this literature the direct rather than negative association between technological change and unemployment is downplayed.]

These visions are premised on universal networking and the infrastructure for the 'information superhighway' linked by optic fibre cables. (The term was coined by Al Gore). There is a political consensus on the desirability of this development. The information age discourse conflates a number of levels of analysis, is variously grounded or not in real-world trends, and is itself highly flexible. The information age can be understood in terms of the regeneration of older industrialised economies and for Anglo-American and European economies a strategic response to the East Asian 'threat', an opportunity for developing countries to move from agrarian to post-industrial mode, as 'virtual' in placed of located institutions, as the demise of hierarchy and the rise of flat structures with greater flexibility of personnel and capacity for initiative. 'At work force level, the discussion is about innovative ways of working such as telework, telecommuting, call centres and telecottages, with the workforce "freed" by the technology from the constraints of location and time' (p. 52). Central to this is the notion of work organisation as a loose web of individuals, capital and technologies, project-focused and structured by changing collaborative networks. The virtual organisation is imagined to be more dynamic, more efficient, more adaptive. 'Market relationships of short duration between self-employed individuals are considered superior to all other forms of employment, particularly in the US literature' (pp. 52-53).

'Teleworkers' are someone working at a place other than where the results of the work are needed, using information and communications technologies. 'Popular writing stresses the freedom which the technology gives to workers to determine how and when they work' (p. 53). Alternatively they may be core employees with privileges and power, autonomy and high trust positions. The discussion of information age work mostly focuses on professional, technical and managerial workers, Reich's 'symbolic analysts'. There is little acknowledgement of more routine jobs such as data entry, word processing and telesales. The information age literature and its popularised concepts are pervasive. The discourse is driven both by a sense that these changes are inevitable, and

that individuals must choose to embrace them or be left behind by history. The role of the manager is understood as 'hero change-agent' (p. 53). Much of the literature is exhortative, a 'call to arms' to executives to restructure as quickly as possible. The selling point is a future of abundance and a now of new commercial opportunities for those abreast of the trends. 'The information age also holds out the promise of being an age of plenty'. [A number of different strands are joined here.] The literature resonates with images of greater diversity in household goods and entertainment. More generally, there is the diversity of cultural forms [in a globalised world]. There are many new job opportunities, and the new products are becoming cheaper. Much of this [is discussed as if economic life has moved beyond scarcity and] ignores the downside of job displacement through automation: the main body of academic research suggests net job loss through the introduction of new technologies (pp. 53-54). There are two sides to the experience of virtual organisations and teleworking.

So far there has been little development of totally virtual organisation, though there are certain companies such as Reebok, Nike and Puma which are constituted by a small central core and extensive computer networking. Self-employment is growing but remains a small proportion of total employment (13 per cent in the UK). Much of the growth of self-employment appears to be driven by declining opportunities in the mainstream labour market, and the rise of outsourcing in place of on-going employees, ie. it is a second-choice option. There is some evidence for the growth of flatter structures and screen-based integrated teams but telematic links between firms are yet to play a significant role, though there is great potential here. The electronic networking between firms in the northern Italian textile and clothing industry are socially and politically driven, rather than technologically driven (pp. 55-56).

Stanworth goes on to discuss various forms of teleworking:

- Those home-based for part of their working week tend to be male, highly skilled and with employee status, autonomy and trust. They are intermittently networked.
- Other employees have less options: they move around to visit clients etc. and have lost a permanent desk space at work ('hot-desking'). 'A variation is "hotelling" where client companies provide workers with access to computer networks and office facilities, rather than the employer' (p. 57).
- Those home-based all of their working time and working for one employer are generally women doing low-skilled clerical work such as data entry, typing or questionnaire encoding. Some are doing more skilled work. They are often treated as self-employed and (poorly) paid by results. They are often isolated from union representation. This kind of routine back office telework appears to be expanding.
- Another category is freelance workers working from home, a skilled or semi-skilled low cost resource, often former employees who have been 'downsized'.
- Mobile telework appears to be on the increase. It augments the productivity of the travelling salesperson, or household service industry worker (gas, household appliance repairs, etc.) who are provided with daily schedules straight into the van.
- Teleworking on remote sites includes call-centre work with customer interface (eg. banking) where companies can tap into married women seeking local part-time employment. Typically this work is low-skill, often it includes shift work and night work. Staff remote from the workplace – whether in low-skilled work or

professional and technical work – are more vulnerable than conventional staff to erosion of their conditions of work, and may have fewer opportunities for job enhancement and promotion. They are 'excluded from social dialogue (p. 58)'.

There is evidence that UK employers are using telework to cut costs by deskilling work or eroding terms and conditions rather than to create post-modern, empowered teleworkers. Homebased and mobile telework and 'hotdesking' are enabling firms to reduce costs by the disposal of office space and there is an increase in offshore telework with firms outsourcing IT work to cheaper locations such as Bangalore, India. Economic pressures and global competition seem to be the drivers for accelerated technological change, but not necessarily with the outcomes for work and employment predicted by the gurus of the information age (p. 58).

It is 'when women and men have skills or experience which is in short supply, telework can be liberating and well-rewarded'. These people are often professionals who have a high degree of discretion in their work. There is no evidence that the information age is reducing routine work, but it is now more easily relocated in cheaper areas or off-shore. Labour market segmentation, gender inequalities and class inequalities continue. Technologies are used to deskill work as well as 'facilitate distributed high discretion jobs', and electronic surveillance can be used to enhance and intensify managerial control (p. 59). There is some evidence of changing practices such as flatter hierarchies within firms and not much on changing relations between firms. Virtual organisations seem scarce, though by their nature they are hard to track. A bipolar social outcome with 'information rich' and 'information poor' appears to be developing. Certainly, this seems more in prospect than a general lifting of all (pp. 59-60). However it is early days yet in relation to all these trends.

Taplin, Ian M. (1995), 'Flexible production, rigid jobs: lessons from the clothing industry', *Work and Occupations*, 22 (4), pp. 412-438.

This study of technological innovation and organisational change in the US apparel industry illuminates the contrary character of what is understood as the revolutionised post-Fordist workplace. 'Flexible production technologies and labour process organisation coexist with "rigid" low-skill, low-paid workers'. The changes to achieve more flexible and responsive production techniques – and lower costs – are driven by management rather than self-regulating highly skilled workers. The new workplace involves heightened pressure on both management and workers alike (p. 413).

Pressures towards greater market segmentation, the need for shortened product development cycles and greater operating flexibility, plus intense low wage competition, encourage the use of microprocessor technologies. This is consistent with some of the post-Fordist vision. But 'it is too simplistic to argue that mass production and flexible specialisation are opposite paradigms because there is ample evidence of the two co-existing under capitalism'. And flexible specialisation often masks intensification of effort (p. 417). Indeed, the increased information potential inherent in microprocessor technology provides firms with both greater flexibility and the retention of existing command and control relations, ie. it is more like 'neo-Fordism' (p. 418).

Managers interviewed all defined flexible production as a way of lowering costs and becoming more responsive to the market 'without making significant investments in worker training and job enrichment'. In most cases work tasks were simplified with workers performing repetitive discrete tasks in a team setting. Teams had specific product tasks and higher productivity was coming from improved coordination of assembly tasks. By not having multiskilled teams, training costs were reduced (p. 430).

Teese, Richard (1994), 'Evaluating school systems: provider versus client perspectives on performance', paper presented at a conference on Public Investment in Schools Education: Costs and Outcomes, sponsored by the Schools Council and the Centre for Economic Policy Research, Australian National University, Canberra, March, pp. 63-92.

Teese argues that the measurement of 'standards' using tests of the 'basics' of literacy and numeracy fail to describe 'the full range of cognitive, cultural and social benefits which flow from schooling. These include generic skills, orientations to learning, attitudes to intellectual work, to technical and artistic accomplishment, moral and aesthetic values, and personal security and well-being' (p. 63). Without assessing outcomes in terms of 'higher order skills and values', no meaningful conclusions can be drawn about how we use resources, and about the distribution of learning differences between individuals. [The argument is convincing.] It is also important to focus on what schools achieve, as well as what they do not (p. 63).

The author then analyses Victorian Year 12 examination results by socio-economic status group and gender, drawing from those data a number of indicators of social and individual differences in education. These data help us to understand how different social groups use schooling. In contrast, test results are less valuable sociologically, as they abstract students from the real institutional framework in which they work, 'that is, independent of the normative classifications' by which they are graded and ranked'. The standards debate and the measures most associated with it tend to obscure the advantages and disadvantages of the different social users (p. 64). From the perspective of the client groups the issue is not whether absolute standards have risen or fallen, or international comparison of attainment: the real issue for the client 'is whether educational effort pays off'. This needs to be measured against the quality of the outcomes the client group obtains relative to those obtained by other groups (p. 65). Teese traces the persistent inequalities between students from different socio-economic backgrounds, and 'the systematic and recurring differences between male and female students' (p. 67). This is a rich analysis which draws out patterns of subject choice, the role of 'hard' disciplines such as mathematics and science as selector subjects, the intersections between patterns of success and failure in schooling and patterns of access to higher education courses, etc.

Teese concludes that social justice objectives, that is a greater social 'evening' in the patterns of performance and success, are best advanced not by broadening the curriculum beyond the traditionally 'hard', abstract subjects – leaving their social function unchanged – but by extending to the weaker social users of schooling the same

'mechanisms of academic security currently monopolised by the most powerful users' (p. 90). That is, by broadening the reach of 'hard' subject study across the whole school population. The primary difficulty here is the universities, whose selection requirements tend to maintain the scarcity of academic learning (pp. 90-91).

> *There cannot be a broad social base of upper secondary students – at least one in which high standards of attainment are widely diffused – and a narrow higher education sector... When all higher education is supplied according to the same model, the extreme relative scarcity of places in the most profitable sectors reacts on access to all other sectors as the best students are displaced to lower levels of the hierarchy by brilliant students, and the poorest students at the lowest levels by the mediocre* (p. 91).

Thus rather than weakening the intellectual demands on school students – especially those from poorer backgrounds – we need to 'diversify the institutional sources of those demands'. That is, everyone should be rewarded for intellectual endeavour, not just students from the social groups and the schools with the best prospects of high success in a system in which academic rewards are so scarce. Thus 'a more diverse higher education sector is essential to support higher levels of effort from all young people and higher standards of achievement amongst all of them (p. 91).

Tegart, Greg, Johnston Ron and Sheehan, Peter (1998), 'Academy study – interim report: a preliminary analysis of the issues', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 1-25.

Knowledge and people are the primary resources in industrialised countries, which are increasingly knowledge-based rather than resource-based. Worldwide 'it is the high technology segment with the highest productivity that has gained the most jobs'. Trade has shifted in favour of higher value-added goods, but other goods remain more important overall (p. 12). Australia is at the low valued-added end but its position is improving. It is strong in science-related biotechnology and genetics, has niches of strength in information and communications technologies (I&CT) and transport, but is weak in precision and control in manufacturing, and new materials (pp. 12-13). 'The competitiveness of Australian firms will be a function of their technologically sophisticated workers' (p. 4). Australia is applying new design and production technologies at half the American rate and also lags behind in training of the appropriate skills.

It has been argued that business process innovation makes a larger contribution to performance and exports than does technological innovation: eg. through changes in job requirements leading to a general skill upgrading, the focus on continuous improvement and on eliminating waste and now unnecessary jobs, flattened structures leading to the abolition of middle management (p. 6). The Anglo-American countries have moved

faster than have the Europeans in work re-organisation (p. 16). International competition is an increasingly important force shaping local industry (Table 5, p. 20).

Major forces shaping industry: results of a survey of leading managers, Australia

Q. What are the major forces shaping your industry?	Agriculture/ Mining/ Infrastructure	Manufacturing	Services	All industries
Proportion who mentioned	%	%	%	%
International competition	24.5	32.7	18.5	25.5
National competition	7.5	11.7	17.6	12.5
Technology	15.0	18.1	29.7	21.2
Skills	12.2	10.0	15.0	12.3
Costs	21.9	14.8	11.3	15.6
Regulation	11.3	10.0	8.0	9.7
Other	7.8	2.7	0.0	3.2
Total	100.0	100.0	100.0	100.0

In fact, 30.6 per cent of those surveyed saw technology as predominantly leading to new products (manufacturing 40.6 per cent, services 30.6 per cent) while 28.3 per cent saw it predominantly cutting costs (agriculture/mining/infrastructure 40.5 per cent, manufacturing 25.2 per cent) and 22.1 per cent see it improving quality (26.0 per cent agriculture etc.). In addition, 19.0 per cent (services 25.8 per cent) see it as leading to new business (p. 24). The planned methods of acquiring new skills are as follows (p. 25):

Methods of acquiring new skills: results of a survey of leading managers, Australia

Q. How do you plan to acquire the new skills needed?	Agriculture/ Mining/ Infrastructure	Manufacturing	Services	All industries
Proportion who mentioned	%	%	%	%
Recruit new skilled labour	22.2	24.8	27.1	24.8
Contract in skills as needed	17.9	16.3	21.5	18.5
External training programs	11.8	17.1	14.0	14.5
Formal in-house training	22.8	21.3	15.6	19.8
On the job training	25.4	20.4	21.9	22.3
Total	100.0	100.0	100.0	100.0

A little less than half planned to bring skills in from outside while the remainder planned training programs, with one third altogether planning to use formal training of existing staff. Reliance on internal staff was weakest in services, where formal in-house training was much less important than contracting in. Note that these are 'leading employers' in large companies. The table provides an indicator of cutting-edge practices in globally competent firms but the preferences of these employers are not indicative of those of all employers.

There has been a profound employment shift to services, both as inputs to industrial processes and to meet final demand (p. 5). The net job effect of technological change

'has to remain an open question'. The number of knowledge workers ('symbolic analysts') required to drive these technologies is comparatively few. Significant numbers of workers are being displaced, eg. in telecommunications, finance, insurance, real estate, wholesale and retail trade (pp. 7-8). Between 1985-86 and 1995-96 in Australia, employment in consumer and business services grew by 3.9 per cent per annum, government, trade and construction services grew 2.2 per cent, manufacturing declined 0.2 per cent. The growth in property and business services (5.8 per cent, from 451,800 to 795,800 persons), accommodation, cafes and restaurants (5.2 per cent) and cultural and recreational services (4.0 per cent) was the most rapid (p. 9). In terms of occupations, the high growth areas were professionals (3.6 per cent) and sales and personal services (4.2 per cent). Tradespersons, and equipment operators/drivers grew slowest (both 0.5 per cent) (p. 11).

In manufacturing and mining, future implications for training include the need to use formal education to develop 'a much broader range of capabilities', and the need for 'continuing skill updating and transformation by the individual' (p. 18).

Tegart, Greg, Johnston Ron and Sheehan, Peter (1998), 'Academy study – final report: conclusions and implications for policy', in Peter Sheehan and Greg Tegart (eds), *Working for the future: technology and employment in the global knowledge economy*, Victoria University Press, Melbourne, pp. 351-365.

The decline of per capita funding in higher education is cause for concern. The pursuit of private income can promote efficiency, and industry-education linkage, but 'it seems that in many cases these pressures may be distracting institutions from their key role of providing a high quality education for Australian students and to contributing to the knowledge base so vital for economic and social development' (p. 362).

We need increased national investment in high quality basic education and research, 'not only in technologies but also in social and cultural areas increasingly relevant to the knowledge economy. The other need is for mechanisms for rapid response to needs: Education and training institutions appear to have become more responsive to business and community needs in recent years, but there appears to be no mechanisms to identify and facilitate an urgent and adequate response to new needs.

> *Education Foundations – joint government/business agencies operating as agents of change, with limited government support and seeking co-investment with business and existing institutions in new educational programs – have proved successful at the state level over the past decade. This approach should be considered as part of a Commonwealth response* (p. 363).

Thomke, Stefan H. (1997), 'The role of flexibility in the development of new products: an empirical study', *Research Policy*, 26, pp. 105-119.

A considerable body of research links flexibility and firm competitiveness. However, most efforts to understand flexibility have focused on manufacturing, the economics of firms, and competitive strategy. Thomke examines the link between *technology* and flexibility during product design, and its impact on development performance and strategies for managing development risk, particularly in environments of high uncertainty. Flexibility is measured in terms of 'the incremental cost and time of modifying a design as a response to endogenous and exogenous change'. 'The ability to rapidly develop innovations of greater complexity with fewer resources has an increasing impact on firm success'. Flexibility during product design accounts for a large number of innovations (p. 105). It is also associated with lower costs of customisation, late changes to production, and product differentiation (p. 109).

His empirical study is of development projects in the field of integrated circuit design. Thomke finds that using the data from his study, 'flexible design technologies' out-performed 'inflexible' technologies by a factor of 2.2, and 'over 23 per cent of that difference can be attributed to differences in managing the risk of design changes' (p. 105). High flexibility enabled designers to tolerate high levels of risk. Low flexibility forced the commitment of high resource investments to minimise the risks in design changes. Flexibility can be a function of several factors: design technology, attributes and choices of designers, the structure of the design itself (p. 106). Improvements in flexibility require investment in new technologies and approaches, but the potential pay-offs are great. Why then don't more firms achieve optimum flexibility?, he asks. Perhaps 'for the same reasons they fail at innovation in general: increasing flexibility requires a departure from old organisational routines and design knowledge – a challenge that has proven to be quite difficult for many organisations' (p. 117). Further:

> *An increase in flexibility is achieved by decoupling robustness and adjustment into two steps: robustness optimilisation and signal adjustment. During the first step, the performance (the signal) is adjusted to meet engineering or customer needs with the aid of an adjustment factor that is determined during step one. An adjustment factor is selected only if changes to it have strong effects on the signal but minimal effects on overall product robustness. The decoupling of robustness and adjustment has significant implications for design flexibility. It suggests that early technology development can focus on robustness alone and that changes to meet evolving needs (eg. adjust height to X) can be made quickly using a low-cost adjustment factor* (p. 117).

In an important passage Thomke notes that organisational *interdependencies* also affect the cost and time of making changes. If a change in one component requires changes in all other components, ie. there is high interdependence, the costs of change are high. 'Design flexibility can be increased by developing a design architecture that minimises interdependence between its individual components'. Modular design helps here. Good architectural designs are made of sub-systems that can be adjusted independently of changes in the environment. If interdependencies are too strong 'a

system may be unable to adapt at a rate that is lower than the rate of change' (p. 117) [and thus the organisational system becomes entirely externally driven, losing its distinctive identity and control over its trajectory of development]. Carefully selecting the boundaries between system components and design tasks to minimise total interdependencies can have a significant impact on flexibility (p. 117).

Thompson, Alexander M. (1992), 'Unproductive expenditure on manufacturing', *Cambridge Journal of Economics*, 16, pp. 147-168.

Expenditure on unproductive activities fails to contribute to creation of new surplus value, and also, are paid for out of previously created surplus value. 'Unproductive expenditures thus have a two-fold tendency to diminish capital accumulation, inhibit economic growth, and promote stagnation'. This interpretation is consistent with Marx as specified by Gough [what about his argument that public spending is 'indirectly productive', not Marx's use of the term?] but diametrically opposed to Baran and Sweezy who argue that unproductive expenditure is necessary to offset underconsumptionist tendencies to stagnation (p. 147).

This analysis of manufacturing does not necessarily provide insights into extractive, agricultural, retail, service, religious or government sectors (p. 148). In manufacturing, profits and unproductive expenditures are jointly and simultaneously determined (p. 147).

> *The diversion of surplus from the circuit of capital to unproductive activity results from an increasing concentration of capital. For monopoly capital, then, its tendency to diminish the social surplus available for future aggregate capital accumulation poses an important contradiction for advanced capitalist economies* (p. 147).

[This suggests the rise of low tax-small government policies can only be explained (1) in *political* not economic terms, and/or (2) as a function of the weakening of capitalist concentration rather than its increase; unless, that is, the main assumption/conclusion is wrong.]

To be productive, labour must not only create use value and exchange value, it must do so in the employ of a capitalist who successfully appropriates the surplus value (p. 148). Wolff includes all labour which creates use value as productive, whether it creates surplus value for the capitalist or not [Wolff, E., 1987, *Growth, accumulation and unproductive activity*, Cambridge University Press, Cambridge]. Unproductive expenditures by capitalist firms are payments from surplus for unproductive labour, together with the value of commodities consumed by the activities of the unproductive labour (p. 148). Supervisory labour is unproductive (p. 148). [It could be argued that supervisory activity adds value by changing the configurations of collective labour.] 'Supervisorial expenditure is necessary to reproduce the exploitative productive relationships of the capitalist enterprise, but does not in itself contribute to surplus value. Other unproductive expenditures are for the labour and material costs of

circulation, the buying and selling of commodities. These activities include selling, advertising, finance, credit, accounting, legal counselling, legislative lobbying, etc.' (p. 149). Further, in footnote: 'Some economists have referred to these activities as indirectly productive, since they are required adjuncts to the directly productive activities of the capitalist enterprise. However, since they make no direct incremental contribution to the surplus themselves, they are properly categorised as unproductive as the term is used by Marx' (p. 149). [Rather, supervisory activities can be either productive or unproductive in that (1) they are part of collective labour, and/or (2) they may add value if separate capitals etc., eg. a time and motion study, rather than a bureaucratic aspect of the company. This raises the broader question of management - does management add value in the technical sense?]

In competition between firms, within the oligopolistic industry structures typical of advanced capitalist economies, 'non-price rivalrous strategies' – together with other structural characteristics of the industry – largely determine the magnitude of surplus claimed by individual enterprise, as well as its decomposition into profit and unproductive expenditure. These characteristics determine allocation and distribution of surplus value but not its absolute volume (p. 149). Conglomerate structures probably reinforce cooperative pricing as in a price war there can be retaliation in other markets. However, while 'oligopolies are frequently able to suppress price competition' they are 'nevertheless powerless to avoid the pursuit of vigorous and costly non-price rivalry'. 'Rivalrous strategies are underwritten by firms' unproductive expenditure and are therefore a key to understanding the decomposition of surplus into profits and unproductive expenditure' (p. 150); eg. advertising campaigns to increase market power. Advertising does not increase the exchange value embodied in a commodity, or surplus value, and therefore is unproductive expenditure. [However the distinction made in the footnote p. 151, between information and persuasion, is meaningless in terms of the discussion of value creation.] Note that media advertising is only one fifth of the cost of selling, the rest is sales wages and commissions, displays, coupons, samples, trade allowances to retailers, etc. (p. 151). Other forms of rivalry include model changes, litigation over intellectual property, antitrust proceedings etc. (p. 151).

> *Mergers and acquisitions are a recently burgeoning sector of corporate strategy, and the transactions costs of these activities must be included in unproductive expenditure. Typical rivalrous objectives of these mergers are market domination via horizontal combination, market foreclosure via vertical integration, and cross-subsidisation, reciprocity, interdependent forbearance and political influence via conglomerate integration* (p. 152).

However socially desirable or privately necessary is R&D 'it is not itself commodity production and labour employed in corporate research and production does not create surplus value' (p. 152). [The exceptions are (1) the firm that conducts own R&D and sells knowledge goods; (2) the firm that sells R&D to other firms.] 'Indeed, the ultimate consequences of changing production technologies and product introduction for aggregate and private surplus are ambiguous, depending upon the size of intramarginal technological rents, the rates of imitation, diffusion, and obsolescence, and the changing labour intensity of production' (p. 152).

Some argue that patents blocking innovations by rivals are just as effective a competitive strategy as introducing new and cheaper methods of production [but surely only in the medium term]. Others suggest that technological efforts directed to model changes are largely directed by the marketing departments of rival firms and are properly considered as selling expenses [?]. The maintenance of excess capacity – to take advantage of any improvement in relative competitiveness – is another rivalrous strategy. 'The unproductive expenditure required by this excess capacity is the opportunity cost of the excess capital and workforce maintained'. Rivalrous firms also maintain higher liquid reserves of working capital [but changes in capital market eg. just-in-time financing means this is less important] (p. 152). 'The targets of a firm's rivalry include not only extant firms but potential entrants as well. These strategies are effective for deterring entry and denying contestability of the market'. New entrants may have to intensify rivalrous expenditures beyond those of the incumbents in order to overcome the market momentum and customer loyalty of the latter (p. 153).

Unproductive expenditures that raise entry barriers, create scale economies or otherwise insulate incumbent firms from market contestibility tend to increase profits [but what about surplus value?]. But profits may be diminished by increased unproductive expenditures because profits are the residual of surplus not allocated to these expenditures' (p. 155). Which of these two kinds of influence has the dominant impact on profits can only be resolved empirically.

In addition to profitability, factors which influence the intensity of rivalry include expected industry growth rates, the type of purchaser, the type of commodity produced, and the scale of the particular firm' (p. 156). 'High expected growth rates should stimulate high levels of rivalry since market shares are likely to be relatively fluid in expanding markets, where successful strategies will generate greater rewards to the firm than would be possible in more mature markets' (p. 156). [He agrees with Auerbach though the reasoning less clear-cut. Note also the interesting point that producer markets work better as classical competitive markets than do consumer markets because of better knowledge of a small number of standardised products.]

> *Purchasers of producer goods tend to specialise in relatively few commodities and to be very knowledgeable of a product's characteristics. They should be less susceptible to many rivalrous tactics than customers of consumer goods who are less knowledgeable and execute a broader range of purchases. The intensity of rivalry is therefore expected to be greater in consumer goods industries* (p. 156).

[However he is wrong about competitiveness – using this reasoning it will be greater in producer markets than consumer markets. Note that the greater the level of consumer knowledge the more the intensity of competition is heightened.] He finds that the empirical test reveals more intense rivalry among firms producing consumer goods than those producing producer goods (p. 161).

'On balance, theoretical considerations fail to indicate whether durable or non-durable goods will experience greater rivalry' (p. 156).

> *Unproductive mark-up appears to have a positive impact upon profit mark-up, though statistically the estimated elasticities are not highly significant. Quite*

possibly, this is a reflection of the theoretical dual nature of the influence of unproductive expenditure upon profits discussed in the preceding section. Empirically, it appears that the dominant impact is from the formation of the rivalry-induced barriers to entry, and that these barriers are sufficient to sustain an increase in surplus which exceeds the increase in unproductive expenditure, the difference being the enhanced profits. This is noticeable since it suggests that the increased unproductive expenditure in the monopoly capital sector of the economy does not diminish the profits of that sector. With their market power, concentrated industries thus appear able to support both elevated unproductive expenditure and elevated profits on the surplus redistributed from the competitive sectors of the economy (p. 161). [But surely it depends on the industry and its stage of historical development?]

In an industry, as the concentration of capital increases, unproductive expenditures and profits both increase, and these increases mutually reinforce one another. 'This last observation means that an increasing concentration of capital results in an increased amount of the social surplus flowing to unproductive uses, but not at the expense of the firms in the industry which make these unproductive expenditures'. The concentration of capital also brings to these firms greater profits and potential accumulation. 'Thus the strategic behaviour which advances the accumulation of the particular firms tends to reduce the aggregate amount of social economic surplus which remains in the circuit of capital and is therefore available for aggregate accumulation. Strategic behaviour which is beneficial and indeed necessary for the individual oligopolist is detrimental for the larger capitalist economy from which the surplus is redistributed. Thus, the concentration of capital embodies a contradiction for the accumulation of capital and would be expected to contribute to the vulnerability of the economy to stagnation and crisis' (p. 164). [I do not find this conclusion convincing.]

Thornton, Robert J., Rodgers, James D. and Brookshire, Michael L. (1997), 'On the interpretation of age-earnings profiles', *Journal of Labor Research*, 18 (2), pp. 351-365.

Thornton et al. argue against the use of cross-sectional age-earnings profiles as a measure of lifetime earnings. They demonstrate that cross-sectional profiles do not accurately portray longitudinal earnings profiles, and show how different the results of the two sets of measures can be.

The earnings peak and decline so universally characteristic of cross-sectional profiles are almost never observed for a cohort's nominal earnings path, and only sometimes for a cohort's real earnings path. Thus, great caution should be exercised whenever cross-sectional data are used to predict the earnings path for a particular individual or cohort of individuals over time (p. 363).

Reading from cross-sectional data, many economists understand the typical earnings pattern over a lifetime as rising rapidly at younger ages, peaking, and then

declining before retirement. The authors provide numerous examples of this kind of reasoning from the literature. However, cross-sectional profiles tend to under-estimate lifetime earnings, and the inverted U shape produced by these data is not always observed in time series earnings data. For example Ruggles and Ruggles (1977) found each birth cohort enjoyed a continual rise in average earnings over its lifetime (p. 357). Cross-sectional findings treat the different historical cohorts as if they are a composite single cohort. But the environment facing cohorts varies, for example in some cohorts there may be labour oversupply, in others undersupply. So different cohorts' lifetime earnings patterns are heterogeneous. Age and cohort effects are compounded and in practice cannot be disentangled (p. 355). Where income declines occur for older workers, this is likely often to be due to reduced hours, but data on age variation by hours of work are somewhat ambiguous (p. 361).

Warnke, Jacqueline (1996), 'Computer manufacturing: change and competition', *Monthly Labor Review*, August, pp. 18-29.

Technological breakthroughs in computing are dramatic and ever upwards. 'Musical birthday cards have more computing power than existed anywhere in the world, prior to 1950' (p. 18). The decline in cost is equally dramatic. In 1975 the mainframe could compute 10 million instructions per second at a cost of $10 million. Now the leading microprocessors compute 66 million instructions per second for $2000-3000. The cost of computing one million instructions has dropped from $1 million to $66 (p. 21).

Price and speed of computers, selected years 1975-95

Year	Device	Million instructions per second	Price (US$s)	Price per million instructions per second (US$s)
1975	IBM Mainframe	10	10,000,000	1,000,000
1981	IBM PC	0.25	3,000	12,000
1994	Intel Pentium	66	3,000	45

The consequences in terms of employment in the industry are uneven, however. Between 1960 and 1984 employment in computer manufacturing almost tripled but from 1984-1995 the industry lost 32 per cent of its workforce (p. 18). From 1993 through to 1995, IBM laid off 120,000 people (p. 23). The trend to net job loss within the industry is expected to continue into the next century (p. 28).

Worren, Nicolay A.M. and Koestner, Richard (1996), 'Seeking innovating team players: contextual determinants of preferred applicant attributes', *The International Journal of Human Resource Management*, 7 (2), pp. 521-533.

Personnel managers in two countries, Norway and Canada, were interviewed. It was found that both groups placed a high value on employees who can adapt to change and generate new ideas. There were also strong preferences for national cultural factors and two other organisational attributes: team orientation, and product development focus. There was one important variation between the two countries: cooperativeness was valued especially highly in Norway – especially in organisations that espoused a team orientation – but not in Canada. In organisations with a strong product development focus, creativity was valued especially highly.

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